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# **GCE A LEVEL EXAMINERS' REPORTS**

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**CHEMISTRY  
A LEVEL**

**SUMMER 2018**

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**CHEMISTRY**  
**GCE A LEVEL**  
**Summer 2018**  
**COMPONENT 1**

This paper was attempted by 172 candidates and differentiated well with 100 marks between the lowest and highest marks attained. Each question on the paper showed a wide variety of marks, and no question proved inaccessible to all candidates. Almost all candidates attempted all questions, with no indication that candidates were unable to complete the paper in time.

In general recall of facts was a strength for many candidates and it was clear that the shorter questions were most accessible. Work that would be studied as part of the AS course was often answered well. The answers provided to extended answers showed an improvement from last year, with fewer answers gaining marks in the lowest band.

Practical methods remain an issue for many candidates, and their ability to evaluate and improve practical methods is an area that needs improvement. Some candidates also lacked precision in their work, which impacted their performance across several questions. This manifested itself in misuse of key terms such as enthalpy and entropy, or atom, molecule and ion. In calculations this led to misuse of units, especially with SI prefixes. Questions that required candidates to interpret a range of information and observations, such as parts of questions 11, 13 and 14, proved to be more challenging.

**Section A**

1. (a) This question was well answered by most, with most giving the short form electronic structure. A few gave arrows in boxes which were also acceptable.  
(b) Most candidates gained the marks for this question, although weaker candidates referred to factors such as nuclear charge and shielding rather than the pairing of electrons. Some candidates referred to phosphorus or sulfur only and did not compare the two.
2. This was answered correctly by most, with the few incorrect answers usually giving a face centred cubic structure.
3. This was recalled correctly by most.
4. Stronger candidates gained both marks here. Some candidates did not distinguish between ammonia and ammonium, or did not show the coordinate bond in the ammonium ion.
5. This reaction should be familiar to all students from their GCE studies but also their GCSE studies. It was disappointing to see so many candidates giving calcium oxide as a product, or not including hydrogen gas as a product.
6. Most were able to identify the lone pairs and bond pairs in the molecule. The shapes given varied, with most identifying this as V-shaped or bent, however trigonal planar and tetrahedral were also common answers.

7. (a) Most could balance this equation.
- (b) Almost all candidates identified that the chlorine was the element undergoing disproportionation, although a very small number thought sodium or hydrogen were involved.
8. Most recalled the details of the standard hydrogen electrode, however the temperature was not included in some answers.

## Section B

9. (a) (i) Most candidates gained this mark. The most common incorrect answer was  $-645 \text{ kJ mol}^{-1}$  where candidates did not differentiate between the enthalpy of lattice formation and breaking. A few candidates attempted more extensive calculations and did not realise that as the question required them to 'state', an extended calculation would not be appropriate.
- (ii) Most candidates could calculate this value correctly.
- (iii) I This calculation was more challenging and many candidates did not distinguish between the enthalpy of hydration and enthalpy of solution. These candidates did not include the lattice enthalpy in their calculation and so failed to obtain the correct value.
- II Most candidates realised that entropy was the additional factor and gained most or all of the marks. Some gave answers based on the need for a negative value of Gibbs free energy, but not all of these elaborated on the need for an entropy increase to allow this to occur.
- (b) Most gained some marks here but few gained all the marks available. The most common errors were answers that did not include Avogadro's number to convert from  $\text{kJ mol}^{-1}$  to energy for each atom and incorrect use of the SI prefixes present in kJ and THz.
10. (a) (i) This question was generally well answered, with most candidates able to discuss the effects of temperature and pressure on the yield of product. Most discussed the effect of temperature on rate but fewer linked pressure to rate. Only the best answers linked ideas together, such as the need for compromises in the temperature used, and the idea that a catalyst can lead to higher yield as lower temperatures can be used.
- (ii) Most attempted this question well, and understood the effect of the yield on the mass of the product. Some did not change units from tonnes to kg, but still gained two out of three marks.
- (b) (i) Most candidates could recall the formula of this ion.
- (ii) Most recalled that the d-orbitals in the  $\text{Cu}^+$  ion are filled however not all could explain why this meant that the compounds are not coloured.

- (iii) The colour of this complex was recalled by most. A significant minority could not draw the complex correctly – some failed to show the bonds between the copper and the nitrogen or oxygen atoms, whilst others included six, three or two ammonia ligands.
11. (a) Most candidates knew that lead(II) iodide was not white.
- (b) This question required candidates to analyse the proposed method to identify any problems with it. Many found this a challenging task.
- (i) Some candidates could identify that the issue here was linked to sodium carbonate and/or potassium carbonate, however not all could explain that these carbonates are soluble.
- (ii) Most candidates could suggest an appropriate acid for the experiment, but the reasons why hydrochloric acid is not appropriate were not explained well. Many candidates thought that hydrochloric acid was too strong!
- (iii) The colours of the flame tests for calcium, potassium and sodium were recalled by most. Unfortunately a significant number still believe that magnesium gives a white flame test.
- (iv) Candidates were required to evaluate a shorter method here and identify which compounds could not be distinguished. This challenged many candidates, but a number gained full marks here. Where candidates selected an incorrect pair of compounds, they could still gain marks for an appropriate method to distinguish between the pair. Unfortunately many candidates suggested magnesium hydroxide as one of the compounds and then referred to it as a solution that gave a precipitate in a reaction. This did not gain credit.
12. (a) This was well answered.
- (b) This question discusses the radiation emitted during a decay process, however many candidates suggested electron capture rather than positron emission.
- (c) (i) Most candidates identified the correct species although a few did not identify which isotopomer gave the peak.
- (ii) Many candidates could identify that the ratio of the two isotopes in the difluoromethanol is 1:1. Some realised this must mean that two half-lives have passed, however others thought that the  $^{18}\text{F}$  would be converted into  $^{19}\text{F}$  and so thought a non-integral number of half-lives had passed.
- (d) (i) The answers to this question were varied. Most realised that the ionisation energies must increase in turn, with a significant jump present. Unfortunately the large jump was not always in the correct location with a jump after 2 electrons or after 5 electrons seen, with some candidates having two significant jumps after 4 and 6 electrons. Some weaker candidates had decreases in ionisation energy in the pattern.

- (ii) This was poorly answered. Many linked the jump to the electronic structure but did not then link this to the group of the periodic table. Few referred to the period of the element linked to the diagram.
13. (a) This was generally well answered. The most common incorrect answers lacked the factor of 10 for the 25 cm<sup>3</sup> sample taken from the 250 cm<sup>3</sup> of solution.
- (b) This was poorly answered. Most answers calculated the masses of the two precipitates, and divided one by the other to obtain an answer of 62.4%. Few completed the correct calculation.
- (c) Most could gain credit for their answers to this question. A wide variety of methods for finding additional evidence were accepted but a vague 'repeat your method' was not sufficient.
- (d) Both these pH calculations were answered well by many. A few assumed their answers were incorrect as their answers were unexpected, with many assuming a pH above 14 was not possible. The most common calculation error was forgetting the minus in the initial pH in part (i).
14. (a) Almost all knew the physical states of the elements, with only the weakest suggesting bromine was a gas. Most understood the effects of van der Waals forces although some discussed the relative strength of the covalent bonds present.
- (b) (i) Some candidates assumed the concentration of calcium ions in both solutions would be the same without referring to the data. Those that undertook calculations approached the question in different ways but most were able to show that the concentrations were different.
- (ii) This was generally well answered with most gaining at least two marks. Some candidates gave descriptive answers referring to hydrophilic and hydrophobic regions without explaining the intermolecular forces associated with either and did not gain full marks.
- (c) (i) Almost all candidates recalled these standard conditions.
- (ii) I Most gained the mark here for the value of light absorbed by the solvent, although a few suggested 55% or 47.5%.
- II Most gained marks for describing the shape of the graph and many explained this using collision theory. Fewer could use the graph correctly to show the reaction is first order, with many stating there is a constant half-life or the rate halves when the concentration halves but unable to show this. Candidates often stated that the absorbance halved from 75% to 37.5% and did not realise that this is a change in absorbance of the molecule from 55% to 17.5%.
- (iii) I Most could recall the Arrhenius equation.

II This question was challenging however many gained at least three marks. Although the calculations were performed well by most, a few had negative activation energy values and did not show an understanding that this was not possible.

15. (a) Most gave an acceptable answer to this question.
- (b) (i) Most gained marks here, although a significant number gave the answer 1.44 rather than  $1.44 \times 10^{-3}$ . This was either due to using the pressure in kPa in the calculation rather than Pa, or due to thinking the volume in  $pV = nRT$  was in  $\text{dm}^3$  rather than  $\text{m}^3$ .
- (ii) This was answered well by many, and almost all who had answers to parts (i) and (ii) were able to use them to identify whether the vessel would float.
- (c) (i) Most gained one mark here, but many did not realise that water was not in its standard state.
- (ii) There were a wide range of marks awarded in this question. Candidates who calculated a value based on enthalpies of formation often forgot to include the enthalpy change of vaporisation of water, with other errors being less common. Those using bond energies often made a variety of errors as well.

The ones selecting the enthalpies of formation could usually explain why this was better than the average values used for bond energies. The reasons used by those incorrectly selecting bond energies often showed a lack of understanding of energy calculations.

- (iii) I Most gained the mark here, although some doubled the error in the measurement and assumed each measurement was  $\pm 0.2^\circ\text{C}$  rather than  $0.2^\circ\text{C}$  being the smallest division.
- II Some candidates attempted to use the same reason in both cases stating that the percentage error in the water measurement was larger in the first case and the percentage error in temperature was larger in the second. Many could correctly identify the fact that the water would evaporate or boil in the first example.
- III A range of appropriate improvements were suggested, many linked to the set energetics practical. If candidates suggested insulation this had to be explained carefully – those that suggested that the flask should be insulated did not gain marks as the heat energy must enter the flask for the experiment to be successful.

**CHEMISTRY**  
**GCE A LEVEL**  
**Summer 2018**  
**COMPONENT 2**

**General Comments**

This was the second occasion that this paper has been set and it was felt by the examiners that this paper was quite accessible, but as expected some questions proved to be more challenging. In general the mathematical content of the paper was handled quite well. It was disappointing to see that questions that had a focus on the practical aspects of the qualification were, in general, done poorly.

This Component 2 paper is a long paper that was written to take two and a half hours and carrying 120 marks. As in 2017, there was little evidence of the paper, however, being too long and candidates having to rush their answers.

The responses to this paper again produced a very wide range of marks from about 20 to about 110. A number of scripts were seen that produced marks of 90 or more and it was pleasing to see some detailed chemistry being well expressed in these responses. Questions that clearly obliged candidates to apply their knowledge of organic chemistry in new and novel situations were competently answered.

**Section A**

1. Nearly all candidates gained this first mark. A few did not give the numbers '1,1' or stated that the monomer was an alkane.
2. There were a number of acceptable intermediate oxidation products that gained credit. However most candidates provided the structure of benzene-1,4-dicarboxylic acid.

The examiners felt that to present the formula of an aldehyde group as COH rather than CHO was not worthy of credit.

3. The examiners required the mention of the starting material as a ketone to gain this mark. This was not always provided.
4. The interpretation of the  $^1\text{NMR}$  signals for mesitylene and for TNT was generally given correctly.
5. Most candidates gained both marks for relating the infrared absorption peaks to the correct structure of the compound methoxyethane.
6. Many candidates gave the correct formula for the organic product of the reaction between 2-hydroxybenzenecarboxylic acid and ethanoyl chloride but then used sodium hydrogencarbonate as the reagent that would distinguish between the product and unreacted 2-hydroxybenzenecarboxylic acid.

Both the product (aspirin) and the starting acid will react with  $\text{NaHCO}_3$  to produce bubbles as carbon dioxide is evolved. Correct answers involved the use of bromine or aqueous iron(III) chloride to show the presence of a phenolic  $-\text{OH}$  group.

7. Most candidates knew that when a carboxylic acid is heated with sodalime, a decarboxylation reaction occurs. Fewer candidates realised that both carboxylic acid groups in the dicarboxylic acid react in this way and that benzene is the organic product.
8. Only compound **N** (the 1,3-diol) can form intermolecular hydrogen bonds, resulting in a relatively higher boiling temperature. Many excellent diagrams, showing hydrogen bonding, were seen but some candidates did not show the presence of the lone pair on the oxygen atom.
9. Some candidates did not realise that the **empirical** formula of the compound was provided. As a result they tried to present a structure for the compound  $\text{CH}_4\text{N}$ . The commonest correct answer was  $\text{H}_2\text{N}(\text{CH}_2)_2\text{NH}_2$ .

## Section B

10. (a) Most candidates realised that Fehling's reagent is used to identify an aldehyde group. Some candidates merely said 'red/orange' without specifying that the this product was a solid.
- (b) (i) Many candidates lost a mark here for not realising that glucose has five  $-\text{OH}$  groups and therefore five times as many moles of ethanoic anhydride would be needed, giving 0.015 mol rather than 0.075 mol as the answer.
- (ii) This question was often answered poorly. Many candidates did not show a vertical condenser, and of those who did, the water was sometimes flowing the wrong way. A surprising number heated the mixture in an unsafe way by directly heating the mixture using a Bunsen burner.
- (iii) The account stated that the cooled reaction mixture was poured onto crushed ice and the ice was then allowed to melt, after which the product was filtered. Many candidates applied this statement to deduce that glucose pentaethanoate must therefore be a solid.
- (iv) The **minimum** quantity of hot ethanol was used for recrystallisation as this would result in the maximum amount of product crystallising out on cooling. A number of candidates could not respond to this question.
- (v) Most candidates realised that a lower temperature than expected for the melting temperature implies that the solid is impure in some way. Fewer candidates could suggest what the impurity might be.
- (c) This proved to be a challenging calculation for a some candidates but an encouraging number were able to work through it in a logical manner.

- (d) (i) & (ii) Although it was obvious that candidates were able to understand the graph provided, many could not give their responses in enough detail to gain credit.
- (iii) This question needed careful reading. The percentage of compound **A** oxidised after 15 minutes was 90%. A number of candidates wrote 10%.
- (iv) Many correct answers were seen with the correct use of the equations linking wavelength, frequency and energy.
- (v) This was an easy mark, for which there were a range of correct answers. The toxicity of benzene was a popular correct response.
11. (a) This was the first of the longer 6 mark questions that tested the quality of extended response (QER). The question sometimes proved more challenging than the examiners had anticipated. The commonest weaknesses were to not give enough detail in the reply to the statements given in the question. For example many candidates did not realise that the 2,4-DNP derivatives must have very close melting temperatures if they cannot be distinguished in this way. Unclear responses were also seen for the chemical analysis, where it was quite common to read that they could not be distinguished from each other because they both contained carbon, hydrogen and oxygen.
- (b) (i) The skeletal formula of compound **F** was usually correct.
- (ii) The role of sulfuric acid in this reaction was well understood and most candidates gave a valid reason for the formation of the two alkenes.
- (iii) Nickel was the commonest correct answer as the catalyst for hydrogenation. Nearly all candidates could describe what was meant by a heterogeneous catalyst.
- (iv) The examiners did not believe that pentane and hexane can be separated by simple distillation and that **fractional** distillation stood a greater chance of separating these two alkanes.
- (v) This question was generally well answered and many candidates gained all four marks for commenting on the reasons for the different boiling temperatures of these alkanes.
- (vi) I Nearly all candidates were able to give the displayed formula of the 2-butyl radical.
- II 'Octane' was the commonest correct answer and was an easy mark for many candidates.
12. (a) The mechanism for the electrophilic addition of chlorine to propene was usually correct.
- (b) Most candidates gave the test with bromine to distinguish between an alkene and an alkane.

- (c) (i) The formula of the nucleophile was an easy mark for nearly all candidates.
- (ii) There were a number of answers to this question and many candidates gained both marks. Some mentioned 'cost' but the examiners thought that such a response needed more detail in order to gain credit.
- (d) (i) I The mechanism for the formation of 4-nitromethylbenzene was often given correctly but a number failed to gain credit by omitting the  $\text{H}^+$  ion as a product.
- II Tin (or iron) and hydrochloric acid are the generally recognised reducing agents and were stated by many candidates.
- III This equation provided at least one mark for many candidates (for using  $\text{HNO}_2$ ) but the products were not always correct.
- (ii) I This was an easy two marks for many candidates, who used sodium hydrogencarbonate to distinguish between a carboxylic acid and a phenol.
- II A number of candidates gained this mark for stating how the presence of a nitro group weakened the bond between the oxygen and hydrogen atoms of the phenol group.
13. (a) Nearly all candidates stated that an amino acid contains both acidic and alkaline functional groups.
- (b) (i) Most candidates suggested that the first titration value was a rough initial reading and this gained the mark.
- (ii) There were many correct answers seen, giving the  $M_r$  value of the acid as 131.
- (iii) Many of the candidates who obtained the correct  $M_r$  in part (ii) deduced the correct formula of the  $\alpha$ -amino acid as  $\text{CH}_3(\text{CH}_2)_3\text{CH}(\text{NH}_2)\text{COOH}$ . Some who obtained 131 in (ii) did not draw the amino acid as an **alpha** amino acid and lost credit as a result.
- (c) (i) The identification of a chiral centre in compound **T** was well done.
- (ii) Most candidates also recognised the existence of an N—H bond present in compound **T** (but not in compound **S**) that could be recognised by infrared spectroscopy.
- (iii) Compound **S** cannot form two different peptides as it does not contain an N—H bond. This was deduced by a number of candidates.
- (d) (i) This question could be answered by commenting on the stability of the carbocations involved or by the use of Markovnikov's rule. Some good responses were seen using either strategy.

- (ii) I The difference in electronegativities between bromine and carbon in the bond was the reason for the partial charges. This was stated by most candidates but some did not state which was the more electronegative element.
- II The role of ammonia in this reaction was well known.
- (iii) The formula of the repeating unit was generally correct. Some candidates gave an answer that contained more than one repeating unit and it was not uncommon to see  $\text{—H}_2\text{N}(\text{CH}_2)_{10}\text{C}(\text{O})\text{O—}$  as an answer.
14. (a) (i) The structure and bonding present in benzene provided some sound marks for many candidates.
- (ii) I Most candidates gave the correct answer of 65% for the atom economy for the reaction.
- II This question was poorly done. The question stated that pyrrole reacted in a similar way to benzene but many candidates gave hydrogen as a product for the iodination of pyrrole using iodine. The organic product for the reaction was named and candidates should have realised that the reaction must be similar to the reaction of benzene with chlorine / bromine.
- (b) (i) The answer to this calculation was 14.8g and many correct answers were seen.
- (ii) This was the second of the QER questions in this paper. Almost all candidates gained some credit although sometimes the required equations were not provided. A number of candidates lost marks by not 'ascending the homologous series' by the use of KCN in stage two. Instead they hydrolysed the (chloromethyl)benzene produced in stage 1. This produced phenylmethanol,  $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$ , which they then oxidised by acidified dichromate(VI) to benzenecarboxylic acid,  $\text{C}_6\text{H}_5\text{COOH}$ , rather than the required phenylethanoic acid,  $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$ .
- (iii) Nearly all candidates gained both marks for this mole calculation.
- (iv) I Not many candidates realised that the aliphatic acid chloride, phenylethanoyl chloride,  $\text{C}_6\text{H}_5\text{CH}_2\text{COCl}$ , would be rapidly hydrolysed if water were tried as the solvent, drastically reducing the yield of DEPA.
- II Very few candidates realised that, if an excess of diethylamine were used, then this excess of diethylamine would react with hydrogen chloride and 'push' the position of equilibrium to the product side, increasing the yield of DEPA.

- III Some candidates knew that vacuum distillation reduces the boiling temperature of the products, thereby reducing the chance of decomposition occurring at higher temperatures.
15. (a) (i) The question asked for the test for a C—Cl bond in a compound. It carried four marks but a number of candidates still did not use an alkali to hydrolyse the C—Cl bond.
- (ii) A number of candidates obtained the correct  $M_r$  value of 141.
- (iii) Many candidates realised that neither of the two compounds shown had hydrogen atoms bonded to the central carbon atom and therefore the splitting pattern for both would be the same, although some found it difficult to express their ideas clearly on paper.
- (iv) The correct ketone was pentan-3-one,  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$ , but candidates were asked to deduce this structure using the information provided. Most candidates gained at least two of the three allocated marks.
- (b) (i) The relative molecular mass of compound L was 74. Candidates were required to use the equation  $pV = nRT$  to obtain this value. The commonest mistake was not to use the correct units for pressure, which resulted in a very odd answer for the relative molecular mass.
- (ii) The examiners intended that candidates should use the information to obtain the ester methyl ethanoate, rather than ethyl methanoate (which would produce ethanol on hydrolysis). A number of other non-ester compounds were suggested by some candidates, and, if these fitted the data, then they were given credit.

**CHEMISTRY**  
**GCE A LEVEL**  
**Summer 2018**  
**COMPONENT 3**

**General**

This was the second examination of this unit for the new GCE specification and 172 candidates sat the paper.

This paper 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 4 to 59, with a mean mark of 35.7 out of 60. The best answered questions were questions 2 and 3, with questions 1 and 4 being the least successfully answered.

**Question 1**

This question assessed the quality of extended response (QER) and the mean mark was 3.2 out of 6.

A number of excellent answers were seen. To access the top band candidates had to give the product colours and formulae and equations for two simple reactions to illustrate ligand exchange for complexes of copper(II) ions. Most candidates chose to illustrate their answers with the formation of the  $[\text{Cu}(\text{H}_2\text{O})_2(\text{NH}_3)_4]^{2+}$  and  $[\text{CuCl}_4]^{2-}$  complexes. Other reactions described included the formation of the  $[\text{Cu}(\text{H}_2\text{O})_4(\text{OH})_2]$  complex on the dropwise addition of ammonia solution to the copper(II) sulfate solution.

Where the answer did not include at least one relevant equation, the mark awarded was limited to the middle band.

The majority of candidates could give the colour of at least one of the complexes formed, but weaker candidates were unable to give the formulae of the appropriate complexes and were thus limited to the lower band.

## Question 2

- (a) Well answered, with most candidates able to give the structural formula and systematic name for the fourth isomer of  $C_4H_{10}O$ .
- (b) Surprisingly, a small number of candidates could not name aqueous  $I_2/NaOH$  (or aqueous  $KI/NaClO$ ) as the reagent(s) used to identify butan-2-ol. The mark for the observation (yellow solid) was not awarded if the incorrect reagent(s) were given e.g. aqueous acidified sodium dichromate(VI).
- (c) Poorly answered by some candidates, with a significant number unable to identify the carboxylic acid as the intermediate in the formation of methylpropan-1-ol from methyl propanoyl chloride.
- (d) This calculation was well done with the vast majority of candidates scoring 3 marks.  
Errors seen included using  $24 \text{ dm}^3$  rather than  $24.5 \text{ dm}^3$  as the molar gas volume at 298K, and incorrectly rearranging the expression  $density = mass/volume$ .
- (e) (i) To gain the second mark the diagram had to include a labelled constant temperature water bath / water bath at  $20^\circ\text{C}$  / thermometer shown in the beaker of water.
- (ii) The majority of candidates gained 2 marks for correctly plotting the data and drawing a curve of best fit. However, in a small minority of scripts the curve did not start at the origin.
- (iii) It was pleasing to note that a number of candidates identified the need to use the ideal gas equation to calculate the volume of nitrogen gas formed in the experiment.  
An alternative method using Charles' Law to convert the volume of gas evolved at  $25^\circ\text{C}$  (or  $0^\circ\text{C}$ ) to volume at  $20^\circ\text{C}$  was also seen.  
In a minority of scripts, candidates failed to spot that the experiment was carried out at  $20^\circ\text{C}$  rather than at  $25^\circ\text{C}$ , and thus incorrectly used a molar volume of  $24.5 \text{ dm}^3$  in their calculations.
- (iv) The majority of candidates were able to calculate the rate competently, convert from  $\text{cm}^3 \text{ min}^{-1}$  to  $\text{dm}^3 \text{ min}^{-1}$  and express their final answer for the initial rate of reaction in standard form.  
However, although the question asked for a calculation of the initial rate of reaction, a small minority of candidates calculated the rate at another point on the curve.  
Calculation of the rate constant was again well done and the majority of candidates were able to give the correct unit.

## Question 3

Eight marks were available for correctly identifying the four inorganic salts from the given list of cations and anions. The majority of candidates were able to identify all four cations from the reaction of their solutions with aqueous sodium hydroxide but significantly fewer were able to identify all four anions from the interactions between solutions of their salts.

Candidates were also asked to give an ionic equation for the formation of any one of the precipitates and this proved to be difficult for a few candidates. Many did not balance the equation for the precipitation reaction and omitted one or more of the state symbols.

#### Question 4

- (a) (i) Almost all gained at least 1 mark for calculating the  $R_f$  value of alanine. A minority of candidates failed to see that the solvent start line was drawn at 0.5 cm and thus incorrectly gave the distances travelled by the solvent and alanine as 8.5 cm and 2.7 cm respectively.
- (ii) To gain the mark, an answer stating that *spot 1* corresponds to *both* glycine and serine was required.
- (iii) Poorly answered by the majority of candidates. This question differentiated well. The more able candidates realised that the spot on the right hand side of the chromatogram corresponded to spot 1 from the previous chromatogram, and thus 2 spots should be drawn above (at 3.3 and 3.7 cm). Again, some failed to see that the solvent start line was drawn at 1.0 cm, but they were not penalised a second time for this error.
- (b) The question asked for the structure of one of the dipeptides formed from serine and leucine. A substantial number of wrong answers were seen, including structural formulae with an incorrect amide linkage and/or errors in the structure of the carbon chains.

#### Question 5

- (a) (i)+(ii) Pleasingly, the majority of candidates ordered the six stages of the calculation correctly, then used this scaffolding within the six stages to correctly calculate the value of  $K$  as 33.4.
- (b) 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  $\pm 0.05 \text{ cm}^3$  should be doubled because the burette is read twice.
- (c) (i) The majority of candidates gained at least 1 mark on this question, although a large minority made at least one error e.g. in calculating the concentration of the carboxylic acid and/or using the incorrect expression to determine  $[\text{H}^+]$  for the carboxylic acid.
- (ii) This question required the candidate to sketch the variation in pH when  $0.0200 \text{ mol dm}^{-3}$  aqueous sodium hydroxide was added to  $25.0 \text{ cm}^3$  of the carboxylic acid solution.
- It was disappointing to see a significant number of candidates unable to score more than 2 of the 5 marks, with a few candidates not even including a suitable scale on both axes.
- Other common errors seen included
- the incorrect starting pH for the carboxylic acid solution [ECF allowed from the calculated pH in part (i)]
  - the vertical portion of the curve not drawn above  $23.50 \text{ cm}^3$  of NaOH i.e. the volume of NaOH used at the endpoint
  - poorly sketched curve in the buffer region / pH at equivalence point not shown as  $>7$  / pH on addition of  $50.0 \text{ cm}^3$  of NaOH not shown as 11-13
  - not labelling significant points on the curve e.g. buffer region, half-equivalence point, equivalence point, end point

**CHEMISTRY**  
**GCE A LEVEL**  
**Summer 2018**  
**PRACTICAL ENDORSEMENT**

**General**

September 2017 saw the commencement of the second cycle of Monitoring visits. Each monitoring cycle lasts two years and therefore some centres allocated to EDUQAS will be visited in the 2018-19 academic year.

So far, just over 90% of centres passed on the first monitoring visit in the second cycle. This is comparable with the outcome from the first cycle of visits and also similar to other Awarding Bodies. Centres which failed the first monitoring visit were given support and visited a second time in the same subject. All centres which failed the first visit made by EDUQAS subsequently passed the second visit. In the event that a centre fails a second visit then the other Awarding Bodies are informed. A first visit is then triggered in all the other science subjects offered at A level.

Centres need to be commended for the way in which they have approached Practical Endorsement. Centres have embraced the philosophy behind Practical Endorsement and taken the opportunity to widen the scope of practical work they do with candidates. There was a lot of evidence of good practice and assessment.

The Monitor is required to examine the following evidence during the visit:

- plans for completing and assessing practical work. The centre should have planned to complete the necessary range of practical work required by the specification.
- records of candidate assessment
- a sample of candidate laboratory books
- observe a practical class in which assessment of CPAC is taking place. The Monitor will also need to speak to the teacher about the assessment.

Monitors are asked to monitor the evidence from a year 13 class (i.e. a 2<sup>nd</sup> year A level group) whenever it is offered in a school/ college.

The following points describe some key features observed in centres where 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 practical endorsement and the meaning of CPAC statements.
- Practical books were used in 'real time' at the bench by candidates when completing a practical. In such cases we do not expect to find practical books in immaculate condition.
- The teacher targeted appropriate assessment of CPAC in the practical lesson monitored.
- 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.
- There was use of peer assessment and self-assessment to reflect on practical work. Learners can self-annotate work to facilitate learning.
- There is evidence of good communication between staff teaching on the same qualification.
- Information from CPD was fed back to other members of the team delivering the qualification.

## CPAC statements

Centres are reminded that in order to award a pass, a candidate needs to 'consistently and routinely meet the criteria'. This means there needs to be evidence of multiple occasions where a candidate evidences a pass for each CPAC statement. Please ensure that you have built in suitable opportunities into your assessment plan to allow candidates to generate this evidence.

CPAC 1 This is generally well assessed by most of the centres visited. In a few cases, Monitors observed that candidates did not always carefully follow instructions. Please ensure that you carefully observe how a candidate does his/her work. When assessing more complex procedures consider the use of a check list to aid assessment.

CPAC 2 This is the most difficult CPAC for candidates to evidence since it involves higher level skills. Generally, we do not expect to see this CPAC assessed in the first two terms of an A level course. However, we do expect to see evidence of some assessment of this criterion by the beginning of the second year of the A level course. Some centres made use of the period at the end of the first year to introduce the assessment of this CPAC statement. Please make sure that you know where and when you are going to assess this CPAC. Make sure that you give sufficient time for your candidates to develop the necessary skills before assessing it.

CPAC 3 There is no need to assess this skill every time a practical is completed. There are plenty of opportunities to assess this CPAC so choose the occasions where there are more significant risks or hazards.

In some centres, assessment of strand 3(a) (**identify** hazards and assess risks in a range of practicals) needs strengthening. This can be done by the teacher asking oral questions to learners and using a check-list to record whether learner responses are adequate. Although it is not a requirement that candidates write risk assessments, where risk assessments are done by candidates they certainly provide suitable evidence to this strand.

CPAC3(b) is best assessed by observation of learners doing the practical work.

CPAC 4 There are two elements to this:  
(a) making accurate observations and

(b) obtaining accurate, precise and sufficient data

Observations should be made directly into their practical books. They should not be written on to scraps of paper and copied up at a later time. Tables of information should have appropriate headings and units. Units were not always observed in tables. This is a requirement to achieve the CPAC statement.

It was noticed that during titrations some candidates read a burette to two decimal places by adding a '0' every time without checking the meniscus carefully. Please make sure that candidates are confident about reading a burette to two decimal places. It may be worthwhile considering using a checklist to ensure that candidates doing a titration are assessed correctly.

- CPAC 5 CPAC 4 and CPAC 5 are still occasionally confused by centres.
- CPAC 4 is about recording data 'live' into appropriate tables.
  - CPAC 5 has two main elements: (a) processing data and (b) referencing information.

There should be evidence of learners processing data using graphs and calculations. Centres should require candidates to use software (e.g. Excel) to draw graphs and, on other occasions, to draw them by hand.

The second strand of this CPAC is also important. Candidates must show evidence of referencing sources of information. The information referenced may be, for example, a data or a quote; the information may come from a text book, journal or website. The evidence produced towards this aspect of the CPAC varies considerably among centres. Some have candidates demonstrating referencing on multiple occasions, even using the Harvard System (which exceeds our requirements), while, in other centres, it is rarely evidenced.

A few centres, and therefore candidates, still confuse referencing with a bibliography. There is an important difference.

Centres are reminded to download the following documents which provide support on interpreting CPAC.

- ['The Practical Endorsement Standard'](#)
- 'Pen Portraits' (available on the Secure website)



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