



GCE AS EXAMINERS' REPORTS

**CHEMISTRY
AS**

SUMMER 2022

Grade boundary information for this subject is available on the WJEC public website at:
<https://www.wjecservices.co.uk/MarkToUMS/default.aspx?l=en>

Online Results Analysis

WJEC provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.

Annual Statistical Report

The annual Statistical Report (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

Unit	Page
Component 1	1
Component 2	3

CHEMISTRY

GCE AS

Summer 2022

COMPONENT 1 – THE LANGUAGE OF CHEMISTRY, STRUCTURE OF MATTER AND SIMPLE REACTIONS

General Comments

This paper was accessible to all the candidates with very few questions not attempted. There were some excellent answers seen by many candidates. The paper tested all aspects of the specification – both theory and practical work. The overall performance was very strong.

Comments on individual questions/sections

Section A

This was generally done very well. Noticeable weaknesses, where they occurred, were poor definitions of “polar covalent bond”, lack of knowledge of calculating uncertainties for weighing by difference, and poor recollection of thermal decomposition of Group II hydroxides. Some candidates did not read Q.6 (c) carefully enough and gave a metal instead of a metal compound.

Section B

- Q.7** Probably the most successfully answered question on the paper. Occasionally square brackets were not used in the K_c expression. Some candidates struggled to rearrange the K_c expression and calculate the concentration of chlorine correctly. The main issue in part (c) was failure to refer to Le Chatelier’s principle, as clearly stated in the stem of the question.
- Q.8** This was a more discriminating question. Part (a) (ii) was answered better than part (a) (i). In the latter, candidates often failed to refer to the position of the elements in the Periodic Table or got it the wrong way round. The meaning of ‘electronegativity’ was not always well worded. The calculation in part (b) (v) was generally well done but with one common mistake. Some candidates assumed their answer was already in dm^3 and did not convert from m^3 . Parts (b) (vi) and (b) (vii) were the most challenging. The former because not all candidates were confident at working out oxidation states; the latter because they either used incorrect symbols or failed to complete the equation with HF and two elements.
- Q.9** On the whole, the QER question was answered extremely well. Just a few candidates had not learned how the mass spectrometer works. Some only considered the three molecular peaks, ignoring the two atomic peaks. Incorrect reference to chloride rather than chlorine was quite common. The calculation in part (b) (iii) caused some issues because of incorrect conversion of units. Part (c) was not always well answered with candidates failing to explain their own views using supporting knowledge.

- Q.10** Parts (a) and (b) were generally done well. The best candidates remembered to include details like the 3+ charge on the metal ions and made sure they gave a clear comparison between weak intermolecular forces in gallium and strong metallic bonding in aluminium. The calculations in parts (c) and (d) caused few problems except to those who could not see the $(100 - x)$ relationship between the isotope abundances in (c), and to those who incorrectly included Avogadro's constant in part (d).
- Q.11** The double titration section was handled well. Some candidates need to improve their knowledge of good titration technique. Part (b) caused a few issues for some candidates. A few could not write the correct equation for sodium hydroxide and carbon dioxide. Some failed to read parts I and II carefully enough and calculated the number of moles for the wrong substance. Errors cropped up in part IV for some candidates because they used the incorrect value for molar gas volume at 298K or they failed to scale their answer up to the 1.00 dm³ original solution. Finally, part (c) was well answered although some found the final calculation challenging. Some failed to notice the question asked for the volume added rather than the total volume.

Summary of key points

Candidates should consider the following points to improve performance:

- Learn the meanings of key chemical terms as one or two of these will always be needed on an exam paper and should give access to “easy” marks.
- Make more use of the data booklet for correct symbols, conversion of units and correct gas molar volumes.
- Practise writing chemical equations.
- Read questions carefully, focussing on the details required to answer the question fully and any useful information that may have been given.

As a general comment on behalf of examiners, it would help if candidates made it clear when their answer is continued on the back page. Many used the back page but made no reference to this in the main part of the question paper.

CHEMISTRY

GCE AS

Summer 2022

COMPONENT 2 – ENERGY, RATE AND CHEMISTRY OF CARBON COMPOUNDS

General Comments

Although the number of candidates for this paper increased from 40 in October 2020 to 114, the mean mark was up from 56.4 to 58.5. The vast majority of candidates had prepared thoroughly for this examination and the responses were often well expressed and detailed. The highest mark was 75 and only two candidates scored under 30. Over half the candidates gained over 60 marks (75%).

Section A proved to be very successful for the majority of candidates. In Section B, Q.8 was the best answered and Q.12 proved to be the most difficult. The most accessible parts on the paper were Q.8 (b), Q.8 (c) (i) and Q.3, with the least accessible being Q.11 (b) (iii)/(iv), Q.11 (a) (i) and Q.10 (a) in that order.

It was pleasing to note that once again a significant number of candidates performed very well in most calculation questions and some improvement was seen in identifying the structures of organic compounds. However, there still needs to be an improvement in application of practical work and using NMR spectral data.

Comments on individual questions/sections

Section A

This was very well answered, with the mean mark being just over 8 out of 10.

In Q.1, a number of candidates simply added up the number of carbons and hydrogens and gave 'pentane' as the answer. If given a shortened formula, it is always advisable to draw the structure before attempting to name it. In Q.4, just over two thirds could give a balanced equation for this reaction. The main error was giving an incorrect formula for magnesium ethanoate. Q.7 proved to be the most challenging part of Section A with just under two thirds giving the correct number of three isomers. The most common incorrect answer was four.

Section B

Q.8 This was the most successfully answered question in this section with over two thirds scoring at least 12 out of 13.

- (a) The bonding in propene was very well known. However, a significant number of candidates lost a mark for not referring to propene's chemical behaviour or not being specific enough about the main type of reaction it undergoes.
- (b) Almost all gained the mark by drawing the correct repeat unit of poly(propene).
- (c) Almost everyone knew the type of reaction. However, marks were lost in the mechanism for using methane instead of propane and for failing to use the propyl radical in the termination step.

- (d) About two thirds managed to score full marks for this empirical and molecular formulae calculation. The candidates who rounded the ratio of 1:1.6 to 1:1.5 ending up with a molecular formula of $C_{10}H_{15}$ instead of $C_{10}H_{16}$ lost one mark, while those who rounded it to 1:2 lost two marks.
- Q.9** (a) The vast majority knew that the catalyst was phosphoric acid in part (i). The bond enthalpy calculation was excellently answered with the vast majority gaining all three marks. Some lost a mark for using $\Delta H = \text{bonds formed} - \text{bonds broken}$ in the calculation.
- (b) Most candidates knew the meaning of the enthalpy term, but some lost a mark for omitting oxygen from their answer. The calculation in part (ii) was well answered with around two thirds of candidates obtaining full marks. The main error was failing to give the final answer to 3 significant figures.
- (c) In part (i), the diagram was only fairly well drawn with around a quarter gaining full marks and a further half gaining 2 marks out of 3. Most candidates knew that a condenser had to be used in the upright position and that the water should enter at the bottom and leave at the top. However, far fewer could show how the condenser and the flask were connected and many drew something that looked like a single piece of apparatus. Only around half the candidates could adequately explain how and why the escape of vapour should be prevented during reflux in part (ii). The main error for explaining how, was a failure to state that the liquid returned to the flask. The main error for explaining why, was simply stating that the vapour was flammable. In part (iii), most candidates realised that the ester was ethyl propanoate and drew the correct structure.
- Q.10** Part (a) was the QER question where candidates had to devise an experiment to compare the rates of hydrolysis of the halogenoalkanes. Only a small percentage scored in the higher band with around half scoring in the middle band. Although the vast majority could explain the trend in the expected results, not many could adequately describe an experiment that would work. Almost all candidates refluxed the halogenoalkane with sodium hydroxide and a large number allowed the mixture to cool before adding silver nitrate and timing the reaction. Some candidates did not even add silver nitrate but still thought that a precipitate would form. The percentage yield calculation in part (b) was well answered with around three quarters gaining full marks. However, as in previous years, a minority persisted in only using the percentage and mass and not the molecular mass, so failed to score any marks. Part (c) was well answered. Around two thirds gained at least 3 marks out of 4. Marks tended to be lost for being too vague rather than a lack of knowledge. Candidates stated that C—F bonds were stronger than C—Cl bonds but did not specify that they could not be broken by UV light or that they would not form radicals.
- Q.11** Part (a) (i) was poorly answered with around a third of candidates getting the mark. Many thought that the cotton wool trapped water vapour, others thought that it prevented the carbon dioxide from escaping, while some were too vague saying that it stopped the reagents from escaping. In part (ii), the vast majority scored both marks, but some lost a mark for not referring to 'time' in the answer. Almost all plotted the graph correctly, but only about two thirds gained the mark for drawing a line of best fit. A significant minority drew a straight line instead of a curve. Just over half the candidates gained both marks in part (iv). Marks were lost for reading an axis incorrectly and for calculating the rate without drawing a tangent.

Part (v) was very well answered and most gained both marks. Some lost a mark for using the moles of hydrochloric acid instead of calcium carbonate.

About three quarters obtained marks for drawing a steeper curve and explaining this in terms of collision theory in part (vi). However, only a few realised that the curve levelled out at 170.84 because 0.66 g of carbon dioxide was lost.

- (b) Part (i) was very well answered. The main error was not giving a minus sign for the enthalpy value. The vast majority correctly calculated the percentage error in part (ii). Some candidates thought that the maximum error in the value for the temperature change was 0.1°C rather than 0.2°C, giving an answer of 4.75% instead of 9.5%.

Parts (iii) and (iv) proved to be by far the hardest questions on the paper with only just over 1 in 8 giving correct answers.

In part (iii), the main errors were stating that:

- the temperature remained the same because the same number of moles of acid were used
- the temperature increased without giving a value
- the temperature doubled because the concentration, rather than the volume, of the acid doubled.

In part (iv), the main errors were to say that the temperature change would be lower because nitric acid is a weak acid or stating that the temperature would be the same because the volume and concentration of the acid are the same.

Summary of key points

- Give precise answers, don't be vague. For example:
In Q.9 (c) (i), don't just state 'during reflux the vapour being heated is condensed into a liquid' but state 'during reflux the vapour being heated is condensed and returns into the flask'.
In Q.10 (c), don't just state 'UV light can break CFCs to form radicals' but state 'UV light can break C—Cl bonds in CFCs to form chlorine radicals'.
- A line of best fit on a graph can be a straight line or a curve [Q.11 (a) (iii)]. If the graph is a curve, when calculating a rate at a particular time, a tangent must be drawn at that time [Q.11 (a) (iv)].
- When devising an experiment make sure that the expected results can be obtained from the method given [Q.10 (a)]. In a practical, if an aspect is changed, think through the implications of that change [Q.11 (b) (iii) and (iv)].
- When using NMR spectral data, think how the number of ^{13}C NMR peaks and the number and the relative areas of peaks in ^1H NMR spectra can show if a compound is straight-chained or branched [Q.12 (a)].



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