Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2021

Pearson Edexcel Advanced Subsidiary GCE
In Chemistry (8CH0)
Paper 2: Core Organic and Physical Chemistry

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Introduction

The overall impression gained from the relatively small number of scripts seen, was that most of the candidates taking this examination were relatively weak. There were however a small number of strong candidates who scored very well on this paper. There were a significant number of blank answer spaces, where items were not attempted. Other answers, e.g., 9(a)(i), 9(a)(iv), suggested that there there had clearly been preparation using previous papers, however, subtle changes in the phrasing of the questions were often missed by the students.

Examples of questions which were very similar to those in previous years:

- Q02(b)
- Q03
- Q4(b)
- Q4(c)(iii)
- Q05(a)
- Q05(c)
- Q06(a)
- Q06(b)
- Q06(c)
- Q06(d)
- Q07(b)
- Q08(a)
- Q08(b)(i)
- Q08(b)(ii)
- Q08(b)(iii)
- Q08(c)(i)
- Q08(c)(ii)
- Q09(a)(i)
- Q09(a)(ii)
- Q09(c)(ii)

Examples of questions that were very different/differently phrased to those in previous years:

- Q01
- Q02(a)(i)
- Q02(a)(ii)
- Q04(a)
- Q04(c)(i)
- Q04(c)(ii)

- Q05(b)(i)
- Q05(b)(ii)
- Q07(a)
- Q08(c)(iii)*
- Q09(a)(iii)
- Q09(a)(iv)
- Q09(b)
- Q09(c)(i)
- Q09(c)(iii)

Multiple Choice

The multiple-choice questions were all very straightforward (similar those seen in the Summer 2019 8CH0_02 paper) and most students scored well on these questions.

Question 1

(a) This multiple-choice question on isomerism was very similar to those asked in previous years, but also required students to differentiate between cis/trans and E/Z

Question 2

(a)(i) This question proved to be surprisingly difficult for many students, probably due to the question including Enthalpy Changes of Vaporisation. Although the diagram on the question paper attempted to simplify the problem for candidates, it appeared that many were confused by the inclusion of vaporisation and simply did not attempt the question. However, the graphical presentation of a Hess cycle is always quite challenging for candidates.

(a)(ii) This was a Hess's Law calculation which again seemed to be a challenge for the less able students. However, the mark scheme gave credit for the omission of the Enthalpy Changes of Vaporisation.

(b) This was a straightforward question on enthalpy changes and was familiar to most candidates. Those who chose to answer the question tended to score well.

Question 3

This multiple-choice question used a graphical representation of the Maxwell Boltzmann distribution of molecular energies that was familiar to most candidates and many scored this mark.

Question 4

Although the chemistry in this question is quite simple, the setting will have been unfamiliar to most candidates. Consequently, many struggled with the calculations.

(a) Students were given the formula of the starting material and the formula of the major product. Most candidates at this level were expected to have been able to deduce the equation (although some omitted the states, which were required by the question)

(b) This was a multiple-choice question and required students to apply basic principles of chemistry to make their choice of an answer. Most candidates were successful.

(c)(i) and (ii) These questions were calculations based on the practical details supplied in the question. **Q04(c)(i)** proved to be difficult for most students at this level, most likely because the calculation was relatively unstructured. Few candidates scored well on this question. **Q4(c)(ii)** proved to be more accessible for candidates, but this was a relatively easy calculation.

Question 5

The chemistry in this question, concerning the combustion of fossil fuels, was quite basic.

(a) This should have been an easy question at this level, requiring recall of the formulae of methane, carbon monoxide and water.

(b)(i) This was a question involving application of basic chemical principles to an unfamiliar situation, the combustion of fossil fuels

(b)(ii) This question also supplied candidates with information that they were required to apply to an unfamiliar situation. In this instance they were asked to interpret two (given) equations that are relevant in flue gas desulfurisation

(c) It was expected that the dot and cross diagram of sulfur dioxide would provide a challenge for candidates. It was, however, answered well and many candidates were successful in scoring the mark.

Question 6

(a) This question involved the use of a tangent to a curve as a means of measuring reaction rate at a given time. This question has been presented in this format several times in recent years. Most candidates were familiar with the procedure although the manipulation of the numerical data was less successful.

(b) This multiple-choice question addressed the classification of a hydrolysis mechanism. Most candidates were successful in scoring the mark.

(c) Parts **(i)** and **(ii)** of this question related to the rates of, and conditions for, the hydrolysis of halogenoalkanes. Both of these questions have appeared frequently in past papers and should have been familiar to candidates.

(d) This question involved the conversion of a halogenoalkane to an alkene. **(d)(i)** was a simple recall of reaction conditions. Most candidates did not achieve marks. In **(d)(ii)** candidates struggled with the repeat unit of a polymer. Common errors included the retention of a C=C in the backbone of the polymer, and the inclusion of one or both side groups in the backbone. This is relatively easy chemistry but it does require practice in writing the repeat unit. The errors seen are common with questions relating to repeat units. Part **(iii)** was a more challenging question and there was considerable success by many candidates. Candidates are becoming familiar with the requirement for a mechanism, and it would seem to be a specification topic that has been well taught.

Question 7

This was a question about the solubility of alcohols in water.

(a) This slightly oblique question asked about a homologous series. Whilst it was clear that most candidates knew what was meant by the term 'homologous series', many found it difficult to express their understanding in writing, without ambiguity.

(b) This question explored the candidates' understanding of intermolecular forces, specifically the hydrogen bonding that allows methanol to dissolve in water. It was expected that students would use diagrams to explain and there was in instruction to this effect, however, some students chose to ignore the instruction and struggled with a written description.

Question 8

This question concerned the reactions of cyclohexanol. In general terms it was answered poorly, and weaker candidates declined to answer most of the early parts of this question. Most of these candidates seemed unfamiliar with the reactions of alcohols. A few excellent answers were seen, but these generally related to the more able candidates.

(a) It appeared that weaker candidates were unsure of what was meant by a skeletal formula.

(b)(i) This question asked about the oxidation of a secondary alcohol, requiring both the name and displayed formula of the organic product. It was therefore a demanding question requiring knowledge of the reaction and the ability to write relevant names and formulae.

(b)(ii) This question tested the candidate's understanding of IR spectra. Although worth just 2 marks on this paper, this specification topic tends to be difficult for many candidates, perhaps because it requires a considerable investment in time and effort to understand the basics of IR spectroscopy.

(b)(iii) and (b)(iv) Following on from IR, the question then moved on to another instrumental technique: mass spectrometry. Part **(iii)** was a simple question about finding relative molecular mass from a mass spectrum, but avoided or answered incorrectly by almost all weaker candidates. Part **(iv)** was potentially more challenging but was attempted with more success by candidates across the ability range. Similar questions have been asked in recent years and practice with past papers may have contributed to the candidate performance seen in this question.

(c)(i) This multiple-choice question on reaction classification proved to be a relatively easy mark for most candidates. Application of simple chemical principles gives the required answer.

(c)(ii) This was a relatively complicated question involving density calculations, mole calculation, and % yield. It was intended to discriminate and only the best candidate were able to achieve the final correct answer. Some candidates were able to gain some of the available marks.

(c)(iii)* This was a longer unstructured question and was concerned with the practical aspects of producing a dry sample of product from a given organic reaction. As is usual with this style of question, the data provided gives several clues about the required answer. In general, this question was very poorly answered, with the majority of candidates failing to score any marks at all.

In this type of practical question, it is a marked advantage to have completed any of the relevant practical exercises. Practical experience seemed to be lacking for most candidates, with only the best candidates scoring a modest number of marks for this question.

Question 9

Although the last question on this paper, candidates had more success with this question, indicating that candidates had read the Principal Examiner recommendations for previous years in which the Principal Examiner had suggested that candidates might be more selective in attempting different questions.

(a)(i) Students were relatively successful with this calculation of an enthalpy change for a reaction,

using the supplied data. It was simple and should have been familiar from similar questions in previous years.

(a)(ii) This question followed up on Q09(a)(i) and tested the student's understanding of the reasons for a variation in the enthalpy change for a reaction. Although most candidates gained one of the two available marks, only the better examinees scored the second mark.

(a)(iii) This was a multiple-choice question. Very few candidates were able to answer this question. This may be because atom economy is not frequently examined.

(a)(iv) This was a multiple-choice question. Most students answered this correctly. The equilibrium expression is a familiar topic asked, and in this instance, is about an equation that should also be very familiar.

(b) This question related to the practical aspects of an equilibrium reaction in the chemical industry. Candidate responses were generally not strong. However, this is a challenging topic towards the end of the paper.

(c)(i) This question was about an exothermic reaction taking place on the surface of a copper catalyst. The answer involved an increase in the rate of a reaction as it heated up, and the effect this might have on the copper catalyst. Many students scored the first marking point but very few recognized that the copper would melt. Although it is easy to deduce what will happen if the experiment has not been seen, this is a memorable reaction when observed.

(c)(ii) This question asked the student to produce a reaction profile for the specified exothermic reaction. It required the student to be aware of the difference between a reaction profile diagram and an enthalpy level diagram. Most students scored both available marks on this question.

(c)(iii) This question was descriptive and asked about the processes that take place during heterogeneous catalysis. A question on this topic has featured frequently on this paper in previous years. Those students who had prepared using past papers will have recognized the question and consequently scored well.

Summary

In order to improve their performance, students should:

- Ensure that their writing is legible. Remember, examiners are unfamiliar with your handwriting.
- Ensure that their grammar is correct. The whole sense of a sentence can be changed by one omitted word.
- Read the question carefully and make sure that they are answering the question that has been asked.
- Be selective with the questions that they answer first. Aim to score marks with questions where they know they will score well. Spend a few minutes at the start of the examination reading through the entire paper.
- Attempt every question; there are no marks available for a blank space.
- Write concisely and avoid making the same point multiple time, this is just a waste of time.
- Make sure that comparisons are made when required.
- Write formulae and numbers carefully, checking their legibility.
- Be careful with the precision of curly arrows in organic mechanisms.
- Show all working for calculations and give final answers to an appropriate number of significant figures.
- Explain calculations briefly. Examiners sometimes struggle to make sense of an apparently random array of figures on a page. Examiners are aware of the time constraints in a written exam but a few words to explain the logic will often help the candidate as well as the examiner.
- Do not assume that any question is identical to those set in previous years, even if the item specification is the same.
- Make sure they understand the difference between reagents and conditions, including when catalysts are involved.
- Refer to both bond pairs and lone pairs when applying electron-pair repulsion theory.
- Reread questions and answers, where time permits, to avoid careless mistakes.

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https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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