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Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel GCE
In Chemistry (8CH0)
Paper 02 Core Organic and Physical Chemistry

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Introduction

Candidates were able to demonstrate a full range of knowledge and understanding on this paper, with some clearly very well-prepared giving high quality responses, with others finding the questions much more challenging. Questions requiring knowledge and understanding of practical activities, for example parts of Q04, Q05 and Q06, proved particularly challenging.

Q01

(a)(i) proved to be a friendly starting question, with over 80% of candidates recognising the correct answer.
(a)(ii) was more challenging with candidates tending to focus on the activation energy and discussing the number of particles with more energy than the activation energy rather than answering the question that had been asked. This required a description and explanation of the shape of the distributions with respect to the energy of the particles.
(a)(iii), the second multiple choice question, proved a little harder than the first, though still answered correctly by over 60% of candidates.
(b)(i) scored well for most candidates, with four marks being common. Common errors included use of double headed arrows and reversing the reactants and products.
(b)(ii) was a question where candidates could simply write down their definition of a catalyst, allowing them the mark for providing a lower activation energy.
(c) proved the most challenging of the multiple choice items in this question, with only just over 30% of the candidates giving the right answer.

Q02

(a) required candidates to respond with two uses of waste plastics other than the one given. The specification lists a further three. Most were able to get one mark, usually for recycling. The second mark, for use a feedstock in cracking reactions or for incineration for energy generation, proved harder to score.
(b) this item proved very high scoring as candidates were able to demonstrate an understanding of polymer and monomer, a skill they have practiced since GCSE.
(c) was well answered, with just over 60% scoring the mark here.

Q03

(a)(i) was the first significant calculation, and this proved a reliable source of marks for most candidates, with three marks out of three being the most commonly scored mark on the item.

(a)(ii) was more tricky as candidates answers lacked detail giving answers such as the mean bond enthalpy is an average without explaining what it was an average of. Some candidates gave excellent answers but too many were penalised by the lack of detail.

(b)(i) was scored by very nearly 80% of candidates.

(b)(ii) was also well answered with only about 10% not getting some credit. This equation was not the easiest to balance, but any candidate starting by balancing the number of carbons, then the number of hydrogens, the number of oxygen atoms required and finally number of nitrogen molecules was able to score 2. 1 mark was often scored for the correct substances or balancing correctly an equation giving monatomic nitrogen as a product.

(b)(iii) had a number of possible answers, but was generally not answered particularly well, with too few focussing on the equation and thinking more about combustion in general.

Q04

(a)(i)-(iv) was a set of items focussing on the thermometric titration of ammonia with ethanoic acid, a reaction which cannot be titrated using the usual indicator techniques. The process seemed unfamiliar to a good number of candidates who struggled with practical aspects of the question. The plotting of the points in **(a)(i)** was a friendly start, and most candidates were able to do this. Those who were familiar with the practical were then able to use lines of best fit and find the maximum temperature rise. Unfortunately too often the candidates included the point at 40cm3 of added acid in the rising line which gave all points above the line and was not accepted as a line of best fit. The temperature rise was required in (a)(ii), but more often the maximum temperature was quoted. Candidates must read the question carefully.

In **(a)(iii)** many candidates were confused by the term 'end-point' identifying the end of the neutralisation (at about 39 cm^3) and instead used the volume of 80 cm^3. The final calculation in **(a)(iv)** was better understood, though often errors from earlier questions had to be carried forward.

(b)(i) proved surprisingly difficult for candidates, with only just over 25% scoring the mark.

(b)(ii) was the least scoring part of the paper, with only a tiny number of candidates recognising the heat loss would not be significant at such low temperatures and that the addition of colder ethanoic acid solution would cause the lowering of the temperature.

Q05

(a), the electrophilic addition reaction, proved rather more accessible than the later free-radical substitution items. In **(a)(i)** hydrogen chloride was commonly given, though chlorine was also suggested. The mechanism in **(a)(ii)** was generally well done, with only a few of the usual errors in arrow direction, dipoles and charges seen.
(b) was less well understood, with a variety of reagents and conditions given in **(b)(i)**, though over 60% of candidates identified the reaction was a free radical substitution in (b)(ii). For those who gave the wrong reagent and conditions, it was possible to score some marks in **(b)(iii)** by giving and naming the two product structures. Those with the correct reagents still struggled in **(b)(iii)** with full marks rarely seen.
(b)(iv), (b)(v) and **(b)(vi)** all needed an understanding of the isotopes of chlorine, or were easier if this was understood. Those candidates who recognised this as the key factor scored well, while those that didn't struggled to pick up any marks.

Q06

This was another practical based question, and some candidates were able to acquit themselves well, while others struggled to make headway, though **(a)** was quite commonly scored
(b) was a diagram question, and the diagram here, one of the more straightforward required at this level, was not well drawn in general.
On average candidates scored about half of the marks in **(c)** while in **(d)**, about 50% score the mark in **(d)(i)**. The extended writing answer **(d)(ii)** gave two marks most commonly out of six, though a few candidates were able to score all six marks.
The calculation in **(e)** had a number of valid approaches. Some candidates were able to work through in a step by step fashion, whilst others appeared to quite randomly scatter calculation across the page. Great benefit can be had be identifying each of your calculation so you can follow your route through the calculation. Four out of four was the most common mark obtained.
(f)(i) suffered from a lack of clarity in the written answers with candidates identifying the range in the infra-red spectrum to look for, but not saying how this would be used to establish purity. Similarly, in **(f)(ii)** a lack of detail and clarity meant that marks were not always scored.

Q07

(a) proved very challenging. The initial calculation was not understood by many candidates, though many were able to pick up 1 mark for having half the moles of Cl_2 compared to NO in **(i)**. The sketch graph in **(ii)** was even more difficult, with only a very few candidates getting full marks in these two linked items. The final multiple choice in **(iii)** was just as high scoring as the first, with over 80% getting the right equation.
(b)(i) and **(b)(ii)** gave a range throughout the possible marks, with two being the most common out of four. Common mistakes included the incorrect substances in the

Hess' Law cycle. The final calculation proved quite challenging, with only 10% of candidates getting full marks for these two parts.

Summary

Based on the performance on this paper, students are offered the following advice:

- It has been suggested many times before, but students should read questions with great care, particularly to ensure that the question being answered is not a more common related one.
- Clarity on the unstructured calculations is important. Providing labels such as "The number of moles of 2-methylpropan-2-ol is...." will demonstrate to the examiner exactly what is being calculated and will help them award method marks in the event of an incorrect final answer, as well as providing clarity for the candidate on the longer calculations.
- Further practice of the longer six mark questions which require the identification of 6 key indicative points should be a priority for all students.
- Further practice of diagram drawing would also be of great benefit. There is usually at least one diagram in every suite of examinations and past papers are a valuable resource in identifying what is required.
- Practical work also required an understanding of the techniques used and further work could be devoted to this aspect of study.

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