Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel International Advanced Subsidiary Level
In Chemistry (8CH0) Paper 02 Core Organic and Physical Chemistry

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Grade Boundaries

Grade boundaries for all papers can be found on the website at:
https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Summer 2019
Publications Code 8CH0_02_1906_ER

Introduction

This paper was similar in style and content to other papers in this specification. The questions allowed a range of knowledge and understanding to be demonstrated, and the levels of difficulty allowed good discrimination between the grades. Some learners were clearly very well prepared for this examination, scoring high marks and demonstrating an excellent knowledge and understanding of the topics in the specification with few errors. A number of learners, however, found the paper very challenging and would have benefited from much more preparation to ensure that they knew basic facts and were able to express their ideas with clarity.
There was very little evidence that candidates struggled for time on this paper with very few answers left with no attempt.

Question 1

This question about fuels began with a nomenclature question which the majority of candidates were able to answer correctly. The main error was to give the molecular formula for the answer rather that a structural formula or name. The molecular formula does not show that the molecule is an unbranched chain. Most learners recognised that the next item required an understanding of intermolecular forces, but some believed that bonds were broken in the molecules and that branches of the chain resulted in weaker bonds. The common misconception that boiling involves bond breaking rather that the separation of molecules by the breaking of intermolecular forces is one which would benefit from further work for many learners.
The advantages of cracking were reasonably well known with the idea that smaller molecules were of more use commonly seen, but the formation of alkenes and therefore the possiblity of carrying out reactions of these to produce new and more useful products such as plastics was less common.
The first multiple choice question proved challenging with more incorrect answers than correct ones.

Question 2

The first six items of this question were well answered by most candidates. Some learners mentioned both the fact that a homologous series contained molecules with the same functional group and had the same chemical reactivity. Since the latter comes as a result of the former, these were considered to be the same marking point and so only one mark was scored unless a further characteristic was supplied. Most knew that propene was an alkene and that hydrogen chloride was the reagent in (b)(i). Hydrochloric acid would not work here and a minority of candidates did not score the mark because of this. Many knew that the reaction was an electrophilic addition.
In (c), most learners knew or worked out that potassium cyanide was the correct reagent and most also scored 2 for their understanding of the term ‘structural isomer’. The structure and name for the isomer in (c)(iii) proved much more

challenging. Most candidates drew all the bonds including bonds between the C and the N of the functional group, though not all knew that this was a triple bond. A significant minority drew the structure of butanenitrile, for which the structural formula had been given in (c)(i), suggesting that the question in (c)(iii) had not been read with sufficient care. It is good practice to read each question twice to ensure that the correct question is answered. Where the correct structure was given the name was often incorrect. Both marks in this part were usually only scored by candidates who would go on to achieve an A grade.

Question 3

Part (a) of this question proved to be quite discriminating, with only the most careful learners achieving all 6 marks. In (i), omission of the idea that the reaction was for one mole of fuel or the values for the pressure and a stated temperature meant a mark was lost. Some learners stated that it was the energy required. This also resulted in a lost mark as combustion is always exothermic so it will always release energy, not take it in. Most learners knew the reactants and products in (a)(ii) but some could not balance the equation or remember that the standard state of water was a liquid. A small number used C_8H_{18}(g) despite the fact that it was C_8H_{18} (l) was given in the question. In (a)(iii) the currect curve and position of the products was often seen, but the arrows showing the enthalpy of combustion and the activation energy were not drawn with sufficient care. Both energy changes have a particular value and so should not be drawn with double headed arrows. Both also needed to start and finish in an appopriate place.

Part (b) proved to be a relatively straightforward question with most learners scoring at least 3 marks. The most common mistake was to not balance the equation by putting H_2O rather than $2H_2O$ in the lower box. The calculation proved to be straightforward for many candidates, though occasionally the answer given had the wrong sign.

In part (c) the numerical value for the mean bond enthalpy in (i) was quite often calculated correctly but only a small minority of candidates remembered that mean bond enthalpy measure the energy required to break and bond and so are always endothermic, so the sign needed to be changed to give +413 kJ mol^{-1}. Most of those that remembered this went on to calculate the C-C bond enthalpy in (ii) correctly. There were a significant number of candidates, however, who thought that propane contained 3 carbon-carbon bonds. Those who did not get the correct sign in (i) were still able to score both marks in (ii) if they though the answer was -347 kJ mol^{-1}.

Question 4

This question had an industrial context. In the first part of the question learners sometimes lost marks for a lack of precision. Whilst the concentrations of the reactants and products remains constant at equilibrium they are only very rarely equal, so the use of the word 'same' in a question on this topic is difficult as this suggests they are equal as well as constant. However, it can be used to describe the rates of reaction. Use of constant to describe concentrations and equal to describe rates is the best practice. Many candidates suggested the the equilibrium must carried out in a closed system. This is a condition required for many reactions to form an equilibrium, but is not a characteristic of the system so did not score even though it was often seen. The ideas in (b)(i) and (b)(ii) were very familiar and it was most common for candidates to score all 3 marks. In (c) many learners scored 1 mark, recognising that catalyst caused equilibrium to be approached more quickly or resulted in a lower activation energy but it was much less common to see this applied to an industrial advantage. Where this was given it was usually in terms of lower temperatures being required thus lowering costs.

Question 5

A lack of precision in (a) resulted in the loss of the mark for some. Many answers described condensing products back in the the reaction mixture. This is true for butan-1-ol but not for the but-1-ene which is collected in the gas syringe. The use of bromine water as a test for unsaturation was well known. In (c) the percentage yield calculation was very well understood by higher ability candidates, however lower scoring learners seemed unsure where to begin and failed to score. The unusual calculation in 5(d) proved challenging for all. Some candidates clearly understood what to do, showing working indicating they understood that the number of moles and pressure were constant so the volume depended only on the temperature before correctly completing the calculation. Some candidates made an assumption that the pressure was standard pressure (either 100 or 101 kPa) and then did two $pV = nRT$ calculations to find an answer which was close to the correct one. These candidates were awarded one of the two marks. In (e) those who knew the mechanism of the reaction often scored all 5 marks. The answer to (e)(i), substitution, was often accompanied by nucleophilic, which was correct but not required, or electrophilic which was incorrect and lost the mark. The type of reaction is substitution and it is a nucleophilic mechanism. The test for the –OH group in the alcohol and the expected observation were well known. The mechanism scored well for some learners, with careful positioned arrows and all the relevant lone pairs and dipoles included. Marks were lost through the lack of the dipole on OH^- or the lack of its charge. Dipoles in the 1-bromobutane were not always included. Some did not include the product bromide ion. As a result a range of marks were scored. Some candidates were clearly unsure where to start and so scored 0. The final part of this question was challenging as many learners did not appreciate that, as well as but-1-ene, but-2-ene would be formed. This compound exists as both *cis*- and *trans*- isomers and so the number of isomeric alkene products was, in fact, three.

Question 6

This question, based on what should be a familiar practical technique, scored well. In part 6(a)(i), it was known to be a pipette by many. In 6(a)(ii) the use of distilled water to rinse the burette was probably more common than the correct answer.

Many people use distilled water initially but you must then rinse the burette with the solution to be used, in this case sodium hydroxide solution, to ensure that the sodium hydroxide finally in the burette is not diluted by the distilled water, making the concentration no longer accurate. It is the use of the solution you are going to use which is essential. Answers which said sodium hydroxide solution without saying it was the one to be used or without giving the concentration were allowed. Sodium hydroxide on its own, without an indication that it was in solution, was not. Most candidates got (a)(iii) correct, with each of the other answers occasionally seen. Many candidates knew the answer to (a)(iv) but some did not quantify the idea of similar volumes. A number was required with 'within 0.2 cm^3' or '± 0.1 cm^3' the expected answers. ± 0.2 cm^3 could lead to a difference of 0.4 cm^3 which is too large and so did not score, though it was commonly given as the answer. The calculation in (a)(v) allowed most candidates to score something, while many scored all 5 marks. The final mark in (a) required some consideration of the practical being carried out and those who recognised that red wine being coloured was the key found this an easy mark.
The calculation in (b) was an unusual one. Many candidates could not see where to begin and so did not score.

Question 7

The first part of Q7 was relatively straightforward and most candidates got this mark. The 6 mark question involved logical deduction of three compounds. With questions like this it is important to demonstrate how you have identified the three structures, with some candidates just drawing the three. This will give a maximum of 3 marks. The most commonly missed IPs were the structure of C and some demonstration of an understanding that B must have one of the correct structures because it was an *E*- isomer and must have the higher priority groups above and below the double bond.

Question 8

This question contained an error in the question for (a)(i). The question asks for six missing points to be added instead of five. Many candidates clearly ignored this and plotted the five anyway and moved on. Some clearly recognised the error and annotated their scripts, for example crossing out the six and writing five. Some added an extra sixth point, often in the relatively large gap between the last two points. Any extra points were ignored. While some candidates obviously spent time checking that all the points were there, there was no evidence that candidates ran out of time as a result as the paper had very few gaps in the last few items, even though they were quite challenging. The graph plotting itself was, as usual, very well done. Most learners scored the two marks for this. The most common error was to join each of the dots with single straight lines. This 'dot to dot' approach is not appropriate for this type of continuous data and so did not score that mark. The description of how to find rate values in (a)(ii) scored a range of marks. Most candidates were able to score one or two marks here with many scoring 4. The final two items were challenging. In (b), the stem of the question tells the learners that the reaction is catalysed by hydrogen ions and the equation tells them these are produced in the reaction. Some recognised this and as a result scored one mark. For two marks the idea that there is initially a very low rate as very little hydrogen ion is present and that the rate builds as hydrogen ions are formed scores both marks. In (c) some learners discussed how the measurements themselves might be inaccurate rather than focusing on what was asked in the question which was how the measurement of the initial rate might me less accurate. This was done by drawing a tangent on the graph and the answer, that the tangent drawn is likely to be inaccurate, was recognised by only a few candidates.

Paper Summary

In order to improve their performance, candidates should:

- read the questions carefully to ensure they are answering the question that has been asked;
- practise calculations, including some of the less familiar types;
- practise naming less familiar organic compounds such as nitriles;
- learn the definitions for enthalpy changes but also understand how these appear as equations;
- be careful with precision in answers, for example in mechanism questions always include relevant lone pairs and dipoles and ensure the arrows are correctly positioned;
- always try to show how you have arrived at an answer both in calculations and in longer written answers as these explanation points are often required for marks.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom