Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

October 2021

Pearson Edexcel International Advanced Level In Chemistry (WCH12) Paper 01

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Introduction

The mean mark for the paper was 38.2 which is similar to pre pandemic WCH12 papers. Many candidates were well prepared for this examination and were able to demonstrate a good knowledge across the specification. However, a number found the paper challenging and blank spaces were noted in many scripts.

Section A

The mean mark for the multiple- choice questions was xxxxx. The most challenging question was xx with xxx % achieving the mark. The highest scoring question was xx with xxx % achieving the mark.

Section B

Question 19

(a) The majority of candidates had a reasonable understanding of the enthalpy of combustion experiment and the first two parts of the calculation(i) and (ii) were well understood. However, common errors included using the mass of ethanol instead of the mass of water and adding 273 to the temperature difference. Very few candidates scored full marks for the calculation in (iii). Many failed to to appreciate the precision required and gave the wrong number of significant figures in their final answer and the minus sign was regularly omitted too. In (iv), incomplete combustion scored more frequently than the evaporation of ethanol but very few candidates achieved full marks. In fact many answers mentioned various types of heat loss despite the question specifically saying not to. Water changing state and non-standard conditions were also common wrong answers and this suggested some candidates incorrectly anticipated the mark scheme instead of reading and answering the question posed.

(b) The meaning of *mean bond enthalpy* in (i) was not well understood by the majority of candidates and the most common mark was zero as many responses were too generic and lacked precision. Although a significant number focussed on the word 'mean', few marks were scored as most candidates did not state that the average was taken from a number of compounds. Omitting 'gaseous ' and 'one mole' were also common mistakes. A surprising number of simple arithmetic errors cost marks in the calculation in (ii) with a number of candidates producing wrong answers for both breaking and making bonds. Common mistakes were the wrong number of O=O bonds and many seemed to think that carbon dioxide molecules contained C-O single bonds rather than C=O double bonds. Although the mark scheme allowed a TE mark for the final calculation, some candidates reversed the sum and subtracted bond breaking from bond making, possibly because they thought the final answer should be 'products minus reactants.

(c) Although most got the direction of the arrow correct, balancing proved problematic for many. The final calculation was answered relatively well but a common mistake was not multiplying by 2 when calculating the left hand side value.

Question 20

(a) The hydrolysis of halogenoalkanes was quite well understood by the majority of candidates and most answered (i) correctly. However a lack of attention to detail in not being specific about referring to the strength of C-I bond cost marks in (ii)

(b) The mechanism was clearly a topic that was well known but a lack of precision about the starting and finishing points of the curly arrows was often penalized. Missing the (lone) pair of electrons and the negative charge on the hydroxide ion also cost marks. Candidates need to appreciate the degree of precision required when answering mechanistic questions and practice them regularly.

(c) The need for a comparison of intermolecular forces was recognized by many candidates and a significant number scored the first three marks. However, a few negated mark 1 with the mention of hydrogen bonding and slightly more missed mark 2 by concentrating on the size, rather than the number of electrons in the 1- iodopropane. Very few candidates considered the relative strengths of permanent dipole- permanent dipole forces and so mark 4 was rarely awarded.

(d) There was very little middle ground in this question. Many candidates struggled to identify the type of product formed in this reaction with alcohols, haloalkanes and alkanes regularly seen. However, those that understood that alkenes were formed scored well and generally had a good understanding of skeletal formulae and geometric isomers.

Question 21

(a) Although many candidates were able to write a balanced equation in (i), there were a significant number of errors. These included not balancing the equation and incorrect formulae such as H instead of H_2 and K_2 instead of 2K. The state symbols were mostly correct but solid KOH and aqueous H_2O were sometimes seen. In (ii) the oxidation states were often correctly identified for potassium but those for hydrogen were seen far less frequently. The incorrect starting oxidation state of hydrogen as +2 was seen on occasions (presumably as there were two hydrogens present) and sometimes water was referred to rather than the hydrogen. Oxygen was also wrongly mentioned at times and some simply mixed up oxidation and reduction.

(b) Most candidates knew the phenolphthalein colour change but a number got the colours reversed and a few incorrectly stated purple or red Instead of pink. In the calculation, mark 1 was scored by the majority of candidates but many lost mark 2 for missing the x10 dilution. This resulted in an A_r value of 72.3 and when attributed to Rb scored mark 3 and mark 4. A significant number of candidates subtracted 17 (for OH) from their final answer and a few failed to identify a Group 1 metal despite the fact they had calculated the A_r correctly. Occasionally, candidates got confused between the atomic numbers and relative atomic mass and so identified the wrong metal.

(c) Although the majority of candidates were able to score the mark for saying the relative atomic mass would increase few were able to successfully justify their answer. Most simply said the mass of metal would increase due to the mass of the oil and so did not score mark 2. However, there were some excellent responses that that make it clear that the 0.37g included the mass of oil and so a lower mass of metal would react and so fewer moles of HCl would be produced.

Section C

Question 22

(a) The advantage of bioethanol being a renewable resource was the most frequently seen correct answer. However, there were many vague responses, including ‘good for the environment’ that were simply ignored. Candidates found the second part of the question concerning a disadvantage of bioethanol more challenging. Many responses did mention crops but failed to relate it to food production or land so did not score, others commented on the time taken to produce the bioethanol and carbon dioxide as a product of combustion which also gained no credit.

(b) The most common correct answers were related to the anaerobic respiration of yeast, but responses involving the oxidation of ethanol were also seen. However, many answers were too vague and did not state what the oxygen would react with.

(d) Most candidates correctly identified the hydrogen bond in (i), but some just referred to intermolecular forces without being specific and so did not score. Unfortunately, a number thought that ethanol contained a hydroxide ion and this was responsible for its interaction with water. The problem associated with the hydroscopic nature was generally answered quite poorly in (ii). Most students that did score understood that the energy efficiency would be affected, but answers were often too vague and responses such as damage to the engine and dilution of the ethanol were ignored.

(e) Overall, candidates demonstrated a strong understanding of the effect of temperature and pressure on an equilibrium reaction in (i). Most candidates were able to identify the effect of temperature on the rate and yield and scored IP1 and IP2. Similarly, the majority explained the effect of pressure on the yield and scored IP4. However, a number did not discuss the effect of pressure on rate so IP3 was not awarded as frequently. IP6 was often scored with candidates explaining that high pressure was expensive but the IP5 catalyst mark was the most elusive. Although many candidates said the catalyst improved the rate, they failed to link this to lower temperature being used and energy being saved. Despite this six mark question scoring well, some candidates did get confused with the direction the equilibrium would shift when the temperature was changed and number of candidates also made contradictory statements with regard to the movement of the equilibrium and the effect on yield. The Maxwell- Boltzmann distribution curve question in (ii) proved to be quite challenging. Many candidates labelled the axes incorrectly, with a number getting confused with an energy profile diagram and others drew a second curve on the diagram to show the profile at a different temperature. Despite this, the majority were able to correctly label the unanalysed and catalysed activation energy lines so scored mark 2 and 3. However, some candidates' diagrams were poorly labelled so credit could not be given. Many candidates successfully explained how the catalyst increased the rate of reaction and so scored mark 4, but a number negated this mark by saying the catalyst increased the collision frequency.

(f) This question was misunderstood by most candidates and many did not give an answer. In (i) some referred to a faster rate or discussed the physical properties of the structure without mentioning the increased surface area. In (ii) the most common score was zero. Most answers focused on changing temperature and pressure to shift the equilibrium or discussed changing surface area and or pore size of the catalyst. However, both correct answers were seen, albeit rather infrequently.

Summary

In order to improve their performance , candidates should:

- Read the question carefully, paying particular attention to the number of marks available
- Make sure they are answering the question posed, not a similar question they may have seen before and learned the mark scheme
- Learn definitions of the key terms in the specification
- Practise writing balanced equations, with state symbols for the reactions in the specification
- Practise drawing organic mechanisms, paying particular attention to the starting and finishing point of curly arrows
- Show working for calculations and make sure the sign, units and significant figures are correct

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