Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel International Advanced Subsidiary Level
In Chemistry (WCH03) Paper 01 Chemistry Laboratory Skills I

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 WCH03_01_1906_ER

General comment

Some candidates were very well-prepared for this examination and scored high marks. Many candidates were able to demonstrate that they had a sound knowledge of the practical skills in the topics of the specification and could apply this to the questions with just a few errors or omissions. A significant minority of candidates found the paper very challenging and would benefit from much more preparation to ensure that they know the basic practical skills, can express their ideas clearly and carry out calculations, showing their working.

Question 1

(a)(i) The majority of candidates recognised that the lilac colour of the flame was caused by potassium cations and the gas evolved was oxygen. A significant minority of candidates thought that potassium oxide decomposes to form oxygen. Candidates should be familiar with the thermal decomposition of potassium nitrate.

(a)(ii) Many candidates who thought that an oxide ion was present wrote an equation showing the decomposition of potassium oxide or potassium superoxide into potassium and oxygen. Some wrote the equation for the decomposition of potassium nitrate into potassium oxide, nitrogen dioxide and oxygen or even potassium, nitrogen and oxygen.

(b)(i) The majority of candidates read the question carefully and knew that the cation in **B** had to be from Group 2 of the Periodic Table, but some ignored this information and suggested that a lithium cation was present. Some candidates who gave the correct strontium cation in Test 3, then changed the cation and suggested barium sulfate as the precipitate in Test 4. The majority of candidates identified the bromide anion, although some lost the mark by just stating 'bromine'.

(b)(ii) Many candidates gave a correct ionic equation for the reaction in Test 4, although some omitted one or more state symbols and a small number gave incorrect charges on the ions. A few candidates misread the question and gave the ionic equation for Test 5.

(b)(iii) The majority of candidates knew how to use dilute ammonia solution to distinguish between the silver chloride and silver bromide precipitates. A few candidates confused dilute and concentrated ammonia and some lost a mark by giving the formula of ammonia as NH_4.

Question 2

(a)(i) The majority of candidates identified phosphorus(V) chloride as reagent **X**, although a small number just stated phosphorus chloride or hydrogen chloride.

(a)(ii) The majority of candidates identified hydrogen chloride as the steamy fumes, although chlorine was seen in some responses.

(a)(iii) The majority of candidates identified bromine water as reagent **Y**, although a few suggested hydrogen bromide.

(b) The majority of candidates identified CH_3^+ as the ion giving a peak at $m/e = 15$. Fewer candidates could deduce the peak at $m/e = 31$ and some candidates lost a

mark by writing CH_3O^+ instead of giving the structure. Some candidates lost a mark by omitting one or both of the charges on the ions.
(c) Many candidates were able to use all of the information in the question to deduce the structure of **D**. Some ignored the information that **D** has a branched chain structure and drew a straight chain, while others did not use the information from the mass spectrum and drew a structure that did not contain a CH_2OH group.
(d) Many candidates realised that the infrared spectrum for **D** would have a peak corresponding to the C=C bond and this would be absent in the spectrum of cyclobutanol. Some stated that **D** would have a C=C peak but did not refer to cyclobutanol. A few candidates just referred to the bonds and did not mention the peak or absorption in the spectrum.

Question 3

(a) The copper(II) sulfate solution was in excess, so the most suitable piece of apparatus to measure it is a 25 cm^3 measuring cylinder. Candidates should be able to judge when a measuring cylinder is appropriate and when it is necessary for more accurate apparatus such as a burette or pipette.
(b) Although many candidates realised that the filter paper and copper were not fully dried, many other answers were seen. Candidates should think carefully about their answers as some suggested errors that would give a lower mass of copper than expected, even though the anomalous mass is clearly higher than expected. A few candidates mentioned errors in weighing even though this was excluded in the question.
(c) The standard of graph plotting was quite varied from those candidates who used suitable axes that were clearly labelled, plotted the points accurately and drew a best fit straight line through the origin to those who chose a non-linear scale, gave incomplete labels to the axes, plotted one or more points incorrectly and joined each point to the next. Some candidates would benefit from much more practice in plotting graphs from experimental results.
(d) Almost all candidates could use their graph to determine the mass of copper that would be produced from 0.56 g of iron. Candidates who used a non-linear scale were unable to do this.
(e) Candidates were expected to use their result from part (d) to work out the mole ratio of iron and copper but many chose other pairs of masses from the table or graph, and this was allowed. Some candidates ignored the instruction to show their working so they were just awarded 1 mark if they gave a correct equation. Some candidates did not use the information at the start of the question that one of the products is iron(II) sulfate or iron(III) sulfate and they tried to write very complex equations.
(f) This was the most poorly attempted question on the paper. The majority of candidates did not appreciate that the point of the experiment was to deduce the balanced equation for the reaction so only the mole ratio of iron to copper was needed and this could only be 1 : 1 or 2 : 3. Many vague answers such as 'it makes the calculations easier' were not worthy of credit.

(g) The majority of candidates realised that as 25 cm^3 of copper(II) sulfate was already in excess, using 50 cm^3 would make no difference to the mass of copper produced.

Question 4

(a) Nearly all candidates were able to give the time when the reaction was just complete.

(b) Many candidates were able to draw an acceptable tangent at time t = 0 and calculate the gradient. However, there were many straight lines drawn that did not touch the curve and / or were too short to realistically calculate the gradient. A few candidates drew a straight line from from the origin to the curve at 150 seconds and thought that would represent the initial rate and others drew a tangent at a time other than t = 0. Some candidates were unable to calculate the gradient correctly and some knew the method of calculation but rounded their final answer incorrectly. Some candidates would benefit from more practice in drawing tangents and calculating gradients. The majority of candidates gave the correct units.

(c) (i) The majority of candidates could give two factors that needed to be controlled in the experiments. However, some mentioned mass of marble chips, which had been excluded in the question, and others stated particle size when that is the factor being investigated.

(c) (ii) The majority of candidates realised that the rate of reaction with smaller marble chips would be faster but they did not all realise that the same volume of carbon dioxide would be produced as the same amount of hydrochloric acid was used.

(c) (iii) This question was surprisingly poorly answered. Some candidates just stated that smaller marble chips would have a faster rate of reaction but did not **explain** why. Many candidates did state that the smaller marble chips would have a larger surface area but only a minority stated that the frequency of collisions between hydrochloric acid particles and the marble chips would increase.

(d) The most common answer was that gas would escape between adding the marble chips to the flask and replacing the bung, although some thought the gas would escape when the bung was removed. Some candidates received credit for stating that the carbon dioxide would dissolve in the acid or water.

Question 5

(a) (i) Many candidates realised that the flask is cooled because the reaction is exothermic. However, there were many vague references to violent and vigorous reactions.

(a) (ii) The need for refluxing was generally well-known but some answers were too vague to receive credit, e.g. just stating ‘to prevent gas escaping’. Some candidates thought that refluxing would prevent the mixture from evaporating.

(a) (iii) The diagrams for heating under reflux varied considerably in standard. There were some perfect diagrams that scored 4 marks, showing that those candidates had practiced drawing apparatus during their course of study. Others were very poor and looked as if the candidates had never drawn any apparatus before. The common errors included: drawing the flask and condenser as one piece of apparatus with no join between them, sealing the apparatus with a bung at the top of the condenser, not drawing a jacket for the water to flow around the condenser and heating in an ice bath. Many candidates would benefit from more practice at drawing the apparatus commonly used in a school laboratory.

(a) (iv) Only a minority of candidates could work out a possible impurity that would be collected in the distillate. Many wrote sulfuric acid, potassium dichromate or even anti-bumping granules, not thinking that these would not vaporise at the boiling temperature of propanoic acid.

(b) (i) The calculation to work out the concentration of propanoic acid was generally well answered. The most common error was to leave the concentration in mol dm^{-3} and not multiply it by the molar mass to convert it to g dm^{-3}. A few candidates mixed up the volumes for the acid and alkali but they could score transferred error marks. Candidates should be encouraged to evaluate their final answer and give it to an appropriate number of significant figures rather than leave it as a fraction.

(b) (ii) Many candidates were able to calculate the percentage uncertainty in the pipette measurement. It was surprising to see a large number multiply their answer by 2, presumably confusing a pipette and burette.

Paper Summary

In order to improve their performance, candidates should:

- read the question carefully to make sure that you are answering the question that has been asked and use the information given in the question
- revise the thermal decomposition of nitrates
- practice how to write ionic equations for the reactions for precipitation reactions
- show all your working for calculations, clearly label each intermediate step to state what you are calculating and do not round answers to intermediate steps to 1 significant figure
- carry out as many experiments as you can or watch demonstrations from your teacher or videos so that you are familiar with all the techniques in the specification
- practice drawing graphs, adding a tangent to a curve and calculate the gradient
- practice drawing apparatus used in a school laboratory
- make sure that you understand the reason for each step in the procedure of an experiment.

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