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Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/03 Autumn 2020 series

Version 1

ocr.org.uk/science

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

i	Reports for the Autumn 2020 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate answers.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.
A full copy of the question paper and the mark scheme can be downloaded from OCR.

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Paper 3 series overview

J250/03 is the first of two foundation tier papers for the Chemistry content of Gateway Combined Science A. This component assesses topics C1, C2, C3 and CS7 (PAGs C1–C5).

In general, the paper was accessible to most candidates but also gave higher ability candidates plenty of opportunity to demonstrate their knowledge. Candidates achieved a range of marks from 5 to 36 out of 60, with the majority at the lower end of this range.

There was no evidence that candidates did not have time to finish the examination, but many did not attempt all the questions.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Attempted all the questions • Had a good understanding of experimental procedure, knew the names of apparatus and what they are used for • Could explain their ideas coherently • Could identify the gas released when a metal reacts with acid and knew how to test for that gas • Could write an equation when given the names of the reactants and products, and the formulae (except for the water and carbon dioxide) • Were able to balance equations.	• Did not attempt all the questions, in particular Questions 12 (f) (ii) and 14 were omitted • Were unable to name apparatus used to measure the volume of a liquid • Struggled to interpret some questions well enough to understand what was being asked • Struggled to explain their ideas coherently • Could not name any gases, or did not know how to test for the gas they named • Did not know how to write a symbol equation when given the names of the reactants and products, and the formulae of most.

Section A overview

Candidates answered all the multiple choice questions.
Questions 5, 7 and 9 proved to be the most difficult for candidates.

Comments on responses by question type

Multiple choice questions

1. Almost all candidates knew that distillation involved evaporation and condensation.
2. Most candidates could use melting point and conductivity data to select diamond from the 4 unknown substances.
3. A few candidates correctly chose A, but the majority selected C. Although they realised model 2 was the most recent, they could not interpret the difference between models 1 and 3.
4. Only a few candidates knew that the H^+ ion causes acidity in HCl. Most selected Cl^-.
5. Very few candidates were able to correctly interpret the electrolysis equation to decide what happens to the mass of the individual reactants and products.
6. Only a few candidates could identify Buckminsterfullerene from diagrams of the structures of carbon allotropes. Many candidates confused it with the carbon nanotube, which is also a fullerene.
7. Very few candidates could identify the empirical formula. Most chose C, the molecular formula.
8. Candidates could identify the bonding pairs correctly, but many forgot that Oxygen should have 6 outer electrons so chose B instead of C.
9. Most chose incorrect answers B or C. Candidates do not seem to be familiar with the term 'reducing agent'.
10. Many candidates correctly chose B, but some deducted 3 electrons rather than adding them so wrote A.

Common misconceptions

?	**Misconception**	Many candidates thought the Cl^- ion in HCl was responsible for its acidity, rather than H^+ (Question 4). Candidates should be able to recall that acids form hydrogen ions when they dissolve in water and solutions of alkalis contain hydroxide ions.

?	**Misconception**	Candidates do not understand the difference between molecular and empirical formulae (Question 7). They would benefit from more practice determining the molecular and empirical formulae for given molecules and displayed structures.

Section B overview

There was no evidence that candidates did not have enough time to complete the paper. Many candidates did not attempt all of the questions.

Question 11

11 (a) Many the candidates could select the correct size of an atom.

11 (b) Very few candidates could use the diagram to explain why Magnesium is found in Group 2 and Period 3. Those who realised it was to do with the electrons did not link the number of (outer) electrons or numbers of shells to the Group or Period numbers. Incorrect answers included that it is a metal, or reference to its reactivity or atomic number.

11 (c) (i) Many candidates scored one mark, but most were unable to insert the second correct number. Some appeared to have just guessed 2 different numbers. A few attempted to write a formula e.g. H_2O on the dotted line.

11 (c) (ii) Some candidates could explain how a Magnesium ion is formed. Some knew electrons were transferred but did not state that they were lost, or how many. Many wrote vaguely about reacting with oxygen or ions. A number omitted the question.

11 (d) (i) Many candidates knew there was a difference in the number of one of the sub-atomic particles but did not realise it was neutrons. Some confused the Atomic and Mass numbers or referred to Relative Atomic Mass. Many omitted the question.

11 (d) (ii) Many candidates scored 1 mark for the correct number of protons or neutrons, and a few scored both marks. A common error was to use 24 and 25 as the number of protons or neutrons.

?	**Misconception**	Mass Number and Relative Atomic Mass are not the same, but many candidates confuse them. Mass Number (in isotopes) is the sum of the number of protons and neutrons in a nucleus (Question 11 (d). Relative Atomic Mass is shown on the Periodic Table (Question 15).

Question 12

12 (a) A few candidates knew that a measuring cylinder was used to measure volume. Common wrong answers were measuring tubes, beakers, measuring cups, weighing scales, thermometers, rulers.

12 (c) A few candidates knew that they needed to measure the temperature after the reaction. Some were able to give a higher temperature for (c) (ii) but many omitted the question or did not seem to understand what was required.

12 (d) The correct answer 'heat escaped from the beaker' was selected by most of the candidates.

12 (e) Candidates were unable to interpret the energy level diagram; most failed to mention energy. Some candidates could define activation energy correctly.

12 (f) A few candidates knew that hydrogen was released when metals react with acids, but not many were able to describe the test for hydrogen fully. A few mentioned a 'squeaky pop' but either used a glowing splint or omitted the lighted splint. Some of the answers given in (f) (i) were not gases.

Question 13

13 Most candidates knew that the separation technique was called chromatography, but not many could name the mobile phase or knew that the dyes must be soluble in the water.

13 (c) Some of candidates could explain their choice of Yes or No clearly. Others did not score as they were unable to explain their answer clearly enough. Some candidates did not appear to realise that the Rf value could identify the dye.

13 (d) A few candidates calculated this correctly, but some did not give their answer to 2 significant figures. The most common error was to divide 53 by 21 instead of dividing 21 by 53. Many had no idea how to calculate Rf.

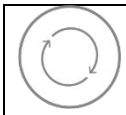
Question 14 – Level of response question

Many candidates gave creditworthy responses, mostly achieving Level 1 or Level 2. A significant number did not attempt this question.

Many candidates were able to compare the data provided but did not always assign the correct type of bonding. Some candidates correctly explained some facts relating to ionic and covalent bonding, but these were not always relevant to the question. Some lower ability candidates thought Y was a metal due to the high melting and boiling points, and that Z was a non-metal. This meant they got confused trying to decide whether they were ionic or covalent.

Many candidates were able to state correct evidence to support their decision, but few went on to explain in terms of structure and bonding. Few mentioned or tried to explain the fact that ionic compounds only conduct when molten – they just referred to ionic compounds conducting and covalent compounds not conducting. Some stated that the compounds (rather than the forces/bonds) were strong or weak. Most could not identify the bonds/forces as ionic or intermolecular.

Level 2 with 4 marks could be achieved by identifying both compounds correctly with at least some evidence drawn from the table. To achieve Level 3, it was necessary to explain the high or low melting/boiling points and/or conductivity in terms of the strength of the forces between particles and whether there were any charged particles that are free to move.

	**AfL**	A useful resource to help candidates with level of response questions can be found at: https://www.ocr.org.uk/Images/561672-how-to-answer-6-mark-lor-activities.zip

Question 15

Most candidates attempted this question and referred to both Periodic Tables to make comparisons. Many mentioned that Mendeleev's table had gaps, more than 1 element in some boxes and contains fewer elements.

Some candidates knew that our modern table arranges elements in order of atomic number or mentioned how elements are grouped nowadays. Many just pointed out differences such as the presence or absence of relative atomic mass, atomic number (or number of protons) and the name of the element. Although this was not what the question was looking for, one mark was given for any one of these answers.

Some vague answers simply referred to the modern table being 'easier to read' or separating out metals and non-metals. Lower ability candidates struggled to explain their ideas coherently enough to gain marks.

Question 16

16 (a) No candidates knew the word 'formulation' and a wide range of incorrect answers were seen.

16 (b) Some candidates managed to calculate the percentage of water but most did not obtain the correct mass of water. Only a few candidates knew how to tackle this calculation.

16 (c) This question was not well answered with only a few candidates mentioning that alcohol has a low boiling point or that energy is required for a liquid to evaporate. Some just repeated the stem of the question when trying to explain why the skin feels cold.

Question 17

17 (a) Many candidates attempted to write either a symbol or word equation. Most candidates were unable to write the formula for magnesium hydroxide using the charges on its ions. Some formulae were written with one or more charges included in them.

17 (b) Only a few candidates were able to use the provided formulae to construct a symbol equation, or to balance it. Most of those who included water and carbon dioxide did get their formulae correct.

17 (c) Those candidates who got the right answer (79.9) linked it correctly to Bromine. Some gained one mark as they subtracted 24.3 from 184.1 but then forgot to half their answer. A few used a 'trial and error' type calculation with different halogen elements to determine their answer. Some just wrote the relative atomic mass of any halogen in part (i) with the matching element name in part (ii). Others just wrote the name of any halogen in part (ii). Several divided 184.1 by 24.3 to obtain 7.6 but did not gain a mark for matching it to Beryllium as this is not a halogen.

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