



---

# **GCSE EXAMINERS' REPORTS**

---

**GCSE  
CHEMISTRY**

**SUMMER 2022**

Grade boundary information for this subject is available on the WJEC public website at:  
<https://www.wjecservices.co.uk/MarkToUMS/default.aspx?!=en>

### **Online Results Analysis**

WJEC provides information to examination centres via the WJEC secure website. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.

### **Annual Statistical Report**

The annual Statistical Report (issued in the second half of the Autumn Term) gives overall outcomes of all examinations administered by WJEC.

<b>Unit</b>	<b>Page</b>
Unit 1 – Foundation Tier	1
Unit 1 – Higher Tier	5
Unit 2 – Foundation Tier	9
Unit 2 – Higher Tier	14
Unit 2 (Contingency) – Foundation Tier	19
Unit 2 (Contingency) – Higher Tier	20

# CHEMISTRY

## GCSE

Summer 2022

### UNIT 1 – FOUNDATION TIER

#### General Comments

Most candidates found the first six questions accessible and very few of them were not attempted. The PISA-style question was well answered and most attempted the QER question. Foundation Tier candidates found the common questions difficult and these were not well answered. The mathematical questions at Foundation Tier level were well answered. Chemical formulae and symbol equations continue to be a struggle. Candidates need to begin by learning how to use the ion table to write formulae.

#### Comments on individual questions/sections

- Q.1**
- (a)**
    - (i)** Very well answered. Most candidates gained one or both marks.
    - (ii)** This was well answered and most candidates identified one or both correct observations for potassium in water.
  - (b)** Candidates continue to have problems in balancing symbol equations at Foundation Tier. Many incorrectly wrote 2 in the box rather than working out the number of atoms of potassium on the right-hand side.
  - (c)** This was well answered. The most common error was that candidates mixed up the flame colours for lithium and sodium.
- Q.2**
- (a)** This was very well answered as nearly all achieved both marks for identifying the correct molecules using the chemical formula.
  - (b)** This was well answered. The most common incorrect answers were carbon oxide, ethene oxide and ethene dioxide.
- Q.3**
- (a)** This was well answered. The most common incorrect answer was 17 (the atomic number of chlorine).
  - (b)** The majority of candidates correctly identified the formula for chlorine gas as  $\text{Cl}_2$ .
  - (c)**
    - (i)** Very well answered.
    - (ii)** Part I was poorly answered. Very few candidates balanced the charges on the ions to give the chemical formula. The most common incorrect answers were  $\text{FeBr}$  and  $\text{FeBr}^3$ . More candidates succeeded in giving the name of the compound in part II. Few candidates did not attempt either part of the question.
  - (d)** Well answered. Most identified the correct use of iodine.

- Q.4**
- (a)
- (i) Most candidates gained one or two marks.
  - (ii) This was poorly answered. Many did not recognise silicon as a non-metal and therefore gave an incorrect fraction.
  - (iii) Well answered.
- (b)
- (i) Well answered with many candidates able to gain credit. A good number achieved full marks. Weaker candidates failed to state that the plates move apart and/or that magma cools/solidifies.
  - (ii) Well answered. Most candidates identified the constructive boundary.
- Q.5**
- (a)
- (i) Very well answered.
  - (ii) This was well answered and most candidates identified magnesium as causing hard water.
  - (iii) The majority of candidates managed to gain one mark. Fewer identified all the correct variables.
- (b)
- (i) Well answered. Most candidates gave the correct temperature.
  - (ii) This was poorly answered. Only a few candidates gained both marks comparing the two solubility curves. Many candidates did not refer to temperature at all and they were unable to gain one of the marks. The most common incorrect answer was to state that the solubility of copper(II) sulfate increases whilst that of sodium chloride stays the same.
  - (iii) Many candidates gained credit for identifying the correct solubility at 40°C or for knowing that they had to multiply a value read from the curve by 10. However, few did both to get two marks. The most common incorrect answers were 28 and 29000.
- (c)
- (i) Well answered. The most common errors were 7 (total number of atoms) and 6 (sum of the numbers in the formula).
  - (ii) Well answered with many candidates able to calculate  $M_r$  correctly.
- Q.6**
- (a)
- (i) This was poorly answered as candidates mixed up the atomic number and mass number or gave the number of neutrons as the mass number.
  - (ii) Most drew the correct electronic structure.
  - (iii) Many candidates gained a mark but very few scored both. Common errors included referring to an incomplete outer shell and different numbers of neutrons. No credit was awarded for stating that charges cancel each other out.
- (b)
- (i) Well answered. The most common incorrect answer was phosphorus (where candidates assumed that Period 1 starts with lithium).

- (ii) Well answered. Many candidates got the mark. Answers referring to 5 electrons but with no mention of the outer shell gained no credit.
  - (iii) Well answered. The most common incorrect answer was to state that the inner shell has 2 electrons.
- Q.7**
- (a) Most candidates gained full credit for the graph. The line of best fit was very obviously a straight line in this case and easily drawn.
  - (b) Many candidates identified the relationship between the two variables but fewer gave a quantitative explanation to gain both marks.
  - (c) Most gained at least one or two marks but few identified all three words. The second statement saw the most errors.
  - (d) This was poorly answered and few Foundation Tier candidates scored any marks. Common errors included 'use more acid' and referring to temperature without stating that it should be increased e.g. change temperature.
- Q.8** Most candidates attempted the QER question on global warming. The consequences of global warming were well-known and the majority of candidates scored two or three marks.
- Lower band answers focused on the loss of habitats especially for polar bears, ice caps melting and sea levels rising. Candidates who were awarded a middle band mark included the increase in carbon dioxide/greenhouse gases and a good description of the problems caused.
- Very few candidates achieved the top band by providing an explanation in terms of carbon dioxide allowing heat to enter the atmosphere but preventing it from escaping. Weaker candidates referred to the depletion of the ozone layer which gained no credit.
- Q.9**
- (a)
    - (i) Part I was very poorly answered. A wide range of incorrect reaction types were given including 'evaporation', 'distillation' and 'oxidation'. In part II few candidates scored one mark and correct equations were very rare. Weaker candidates gave a word equation which was not creditworthy.
    - (ii) This was poorly answered. Most candidates gave hydrogen as the substance added.
  - (b) Well answered with many candidates giving a correct use for limestone in construction e.g. mainly making concrete or cement. No credit was awarded for 'used for building' or for any use outside of construction.
- Q.10**
- (a) This was poorly answered at Foundation Tier as few candidates gave the correct pigment. Many gave **A** as their answer having not read the question carefully. Many of those who correctly answered **C** struggled to clearly state their reasoning.
  - (b) Few candidates gained credit by identifying that solubility is responsible for the different distances travelled. The most common incorrect answers referred to  $R_f$  values, concentration or density.

- (c) This was well answered. Most candidates gained both marks for recognising the correct extract in **B** and that the pigment did not move.
- (d) Many candidates scored full marks for the calculation. Those who divided 12 (rather than 36) by 58 were awarded 1 mark.
- Q.11 (a)** Many candidates identified the decrease in carbon dioxide due to evolution of plants/photosynthesis. Fewer recalled that water vapour condensed to form oceans. Very few achieved three or four marks. Common errors were reference to combustion of fuels and to increasing temperature causing water to evaporate.
- (b) Well answered with many candidates gaining a mark for one correct percentage. Few gained both marks. It was common to see nitrogen as 21% and oxygen as 78%.

### Summary of key points

- Skills in writing chemical formulae and equations should be practised throughout the course. This is a worthwhile investment of time as all papers will have 10 marks or more allocated to this area.
- Calculations introduced in the year 10 unit should be practised in appropriate contexts during the teaching of the year 11 unit as they will be assessed again.
- Understanding of the steps in experimental methods is an area for development.

# CHEMISTRY

## GCSE

Summer 2022

### UNIT 1 – HIGHER TIER

#### General Comments

The PISA-style question was very well answered and many scored well on the QER question. Candidates struggled with expressing the meaning of scientific terminology. The mathematical questions at Higher Tier were disappointing in all areas. Chemical formulae and balancing equations proved to be a struggle for many. Some candidates struggled with the later questions, possibly suggesting that they should have been entered for the Foundation Tier paper.

#### Comments on individual questions/sections

- Q.1**
- (a) (i) Part I was well answered. The most common incorrect answers were 'exothermic', 'endothermic' and 'oxidation'. In part II most candidates gained a mark for giving the correct formula of either the reactant or the products. Relatively few scored both marks. Incorrect formulae such as  $\text{CaO}_2$  and  $\text{CaCO}$  were commonly seen.
- (ii) This was well answered. Weaker candidates gave hydrogen as the substance added to change calcium oxide into calcium hydroxide.
- (b) Well answered.
- Q.2**
- (a) This was well answered at Higher Tier. Many candidates gave the correct extract however fewer clearly stated their reasoning to score full marks. Weaker candidates gave **A** as the extract suggesting they had not read the question carefully.
- (b) Many candidates gained credit by identifying that solubility is responsible for the different distances travelled. The most common incorrect answers referred to  $R_f$  values, concentration or density.
- (c) This was very well answered and most candidates gained both marks by recognising the correct extract in **B** and that the pigment did not move.
- (d) Many candidates scored both marks for the calculation.
- Q.3**
- (a) Most candidates identified the decrease in carbon dioxide due to evolution of plants/photosynthesis. At Higher Tier, more recalled that water vapour condensed to form the oceans. Fewer referred to carbon dioxide being locked in rocks/fossil fuels and/or the decrease in atmospheric temperature that caused the condensation of water vapour. Common errors included referring to combustion of fuels and the temperature of the Earth increasing causing water to evaporate.

- (b) Well answered with many candidates gaining a mark for one correct percentage. Few gained both marks. It was common to see nitrogen as 21% and oxygen as 78%.
- Q.4** (a) (i) This was well answered and most candidates gained two or three marks, although few gained full marks. Some poor plotting was seen but the most common error was to draw a straight line rather than a curve. Candidates need to be reminded that a line of best fit does not necessarily mean a straight line.
- (ii) Many candidates scored one or two marks, whilst few gained all three. Several candidates did not recognise that the change in mass had to be multiplied by 2.5 due to the volume of water used. The weakest candidates simply subtracted  $30^\circ$  from  $80^\circ$  to give an answer of 50 or divided  $250\text{cm}^3$  by this number to give an answer of 5. These errors suggest incorrectly entered candidates.
- (b) Many candidates identified that water and ethanol had different boiling points. Stronger candidates were able to state the physical processes that occurred with the lower boiling point substance.
- Q.5** (a) Very well answered. Most candidates drew the correct electronic structure for aluminium.
- (b) (i) Well answered where most candidates identified the correct isotopes and gave the correct reason. The most common incorrect answers were **C** and **D** (same number of protons, electrons and neutrons) and **B** and **E** (same number of protons and electrons, different number of neutrons).
- (ii) Many candidates identified the correct ions but few gained the mark for the reason. Stating that they had gained or lost an electron was not credited.
- Q.6** (a) (i) Most candidates correctly identified the (apple) green flame colour for barium. Many identified the correct halide ions, although a number mixed them up suggesting that the yellow precipitate identified chloride ions. No credit was awarded when charges were omitted. Fewer candidates linked the brick red flame to the calcium ion.
- (ii) This was poorly answered. Very few candidates stated that there would be a mixture of two precipitates or that the mixture may give a 'cream' precipitate. Some referred to displacement reactions and many did not attempt the question.
- (b) A very poorly answered question. Many candidates wrote a symbol equation rather than an ionic equation reflecting the lack of understanding in this area. Very few gave the correct ionic equation including state symbols.
- Q.7** (a) Very well answered. Most candidates recognised the correct statement.
- (b) Well answered. Many candidates identified the correct catalyst as **Y** as well as referring to the optimum temperature. Few candidates stated that the catalase would denature at higher temperatures. The most common error was to choose catalyst **X** because it produced the greatest volume of gas.

- (c) Very well answered. Most candidates recognised the correct statement.
- Q.8** (a) Most candidates gained one or two marks, mainly for identifying sample **A** as permanent hard water and stating that the volume of soap needed remained the same after boiling. Only the strongest candidates recognised that sample **B** has both permanent and temporary hardness because it is softened partially by boiling and further by ion exchange. The most common error was stating sample **B** contains temporary hardness only.
- (b) Well answered. Many gained one mark for the correct formulae for the products as no ion charge balancing is necessary. The most common incorrect formulae were  $\text{NaCO}_3$ ,  $\text{NaCO}$  and  $\text{MgCl}$  for the reactants and  $\text{MgCO}$ ,  $\text{Mg}_2\text{CO}_3$  and  $\text{NaCl}_2$  for the products.
- Q.9** (a) The QER question was quite well answered. Most candidates attempted the question and gained credit for the observations when the alkali metals react with water. Most scored middle band marks but more higher band answers were seen than in previous years. Lower band candidates described the fizzing of the metals and the increase in reactivity down the group. Middle band responses went on to link the reactivity to the electronic structure of the metals and the desire to lose their outer electron. Few candidates further developed their answers to score a top band mark by linking an increase in shell numbers to weaker attraction between the nucleus and the outer electron.
- (b) (i) The calculation was poorly done and few candidates got the correct answer of 18.8. It could be done by reacting masses or by calculating the number of moles but most showed no understanding of either method. Many made no attempt.
- (ii) This too was poorly answered. Few candidates recognised Avogadro's number and how it relates to moles. Several candidates did not attempt the question, reflecting the lack of understanding. The most common error was to divide the number of moles by Avogadro's number.
- Q.10** (a) (i) Several candidates identified the correct table of results and knew that reactivity decreases as we descend Group 7. Only a few related the reactivity to the displacement reactions taking place. Lack of correct terminology often resulted in explanation marks not being awarded.
- (ii) Many candidates gained one mark for the formulae for the reactants –  $\text{Cl}_2$  and  $\text{NaI}$ . Far fewer gave the correct formulae for the products. The most common incorrect formulae were  $\text{NaCl}_2$  and  $2\text{I}$ .
- (b) Many candidates gained a mark for their calculation method but only a few carried out the correct calculation and ended with the correct formula of  $\text{FeBr}_3$ .

Common errors included:

- dividing the  $A_r$  by the mass ( $\text{Fe } \frac{56}{7}$ ,  $\text{Br } \frac{80}{30}$ )
- using an incorrect mass of bromine
- rounding up the mole number too much  
e.g. 0.125 mol of Fe given as 0.1 and 0.375 mol of Br given as 0.4.

Some candidates gave the correct formula without any working shown. They got no credit.

- Q.11 (a)** This was poorly answered. Very few candidates used the tangent drawn to calculate the rate at the given time. The most common error was to read off the volume at 20s and to divide that volume by 20.
- (b)**
- (i)** Most candidates recognised that the increase in mass would increase the rate of the reaction and drew a steeper curve. This gained one mark. Only the strongest candidates noticed that the mass was 50% greater and that 50% more gas would therefore be produced.
- (ii)** Many candidates gained one mark for linking the increase in mass to an increase in surface area for reaction. The majority had some idea of explaining in terms of collisions but only a small number showed the clarity required by referring to the number of collisions per unit time or the frequency of collisions.

### Summary of key points

- Skills in writing chemical formulae and equations should be practised throughout the course. This is a worthwhile investment of time as all papers will have 10 marks or more allocated to this area.
- Calculations introduced in the year 10 unit should be practised in appropriate contexts during the teaching of the year 11 unit as they will be assessed again.
- Understanding of the steps in experimental methods is an area for development.
- Candidates must use the correct terminology and precise language to avoid losing marks when explaining complex ideas such as changes in reaction rate.

# CHEMISTRY

## GCSE

Summer 2022

### UNIT 2 – FOUNDATION TIER

#### General Comments

The paper was generally well done with a mean mark of 42 out of 80. Foundation Tier candidates struggled somewhat on the common questions, especially Q.8 (bonding) and Q.9 (Haber process).

Spelling was generally poor and some candidates were not able to accurately write scientific terms given in the question. Many candidates were unable to read and/or understand questions requiring more than a one-word answer. The quality of extended prose was generally poor.

Candidates demonstrated a good knowledge and understanding of the following areas of the specification:

- distillation of crude oil
- electrolysis of a molten compound
- preparation of copper(II) chloride.

Candidates demonstrated a lack of knowledge and understanding of the following areas of the specification:

- the extraction of iron in the blast furnace
- simple symbol equations
- ionic and covalent bonding
- Haber process
- reactivity series.

#### Comments on individual questions/sections

**Q.1 (a)** Generally well answered. Most candidates were able to accurately name pieces of laboratory apparatus.

**(b)** Well answered.

**(c)** Surprisingly poorly answered. The most common incorrect response was 'hydrogen'.

Many candidates did not see the significance of a carbonate being used in stage 1 which gave an additional clue.

**(d)** Well answered.

- (e) Weak candidates failed to recognise that a simple subtraction was needed in this question. Examples were seen where the two numbers were multiplied and some candidates attempted to calculate a percentage. Even some candidates who understood what was required were unable to subtract 29.8 from 43.7.
- Q.2**
- (a) 'Thousands of years' was a common incorrect answer.
- (b) 'Cracking' was the most common incorrect answer. Candidates were unable to make the link between fractions (given in the question) and fractional distillation.
- (c) This question was generally well answered. In part (iv) most candidates correctly chose 'petrol' however they failed to gain the second mark because they listed more than one property e.g. forms no smoke and ignites very easily.
- Q.3**
- (a) Generally well answered. A few candidates lost the mark for the structural formula of propane due to missing out the bonds between the carbon atoms.
- (b) Well answered. The most common incorrect answer was 'A'.
- (c) Poorly answered. 'Universal indicator' and 'barium chloride' were common incorrect answers.
- (d) Poorly answered. Most candidates did not know the chemical name for  $C_2H_5OH$ .
- (e) Most candidates understood they had to add the relative atomic masses given in the question. Unfortunately, weaker candidates added them in all sorts of combinations. Ethanol proved too difficult an example for the Foundation Tier paper.
- Q.4**
- (a) Generally well answered.
- (i) 'Pb<sub>2</sub>Br' was the most common incorrect answer.
- (ii) Well answered.
- (iii) 'Bromide' was the most common incorrect answer. 'Bromine water' gained no credit.
- (iv) Well answered.
- (b) (i) Poorly answered. Many candidates were not aware that 'coke' was used to heat the furnace or that air provides 'oxygen'. Most were aware that impurities are removed by adding 'limestone'.
- (ii) Generally well answered but a significant number gave 'C' as an incorrect answer.
- (c) (i)–(iii) Well answered. Most candidates were able to extract and/or use the information presented in the table.

- (iv) This was poorly answered. Most candidates who correctly chose 'A' as representing cast iron failed to refer back to the table and recognise that cast iron contains only two different types of atoms.

Q.5 (a) (i)&(ii) Well answered.

- (iii) Poorly answered. Only the stronger Foundation Tier candidates gained both marks for this question. Most did not understand what the question was asking them to do. They simply chose a student name and then explained how cotton wool, a lid or a copper cup affects the investigation.

- (iv) Poorly answered. Most candidates failed to complete this simple symbol equation representing a familiar displacement reaction. Some gave names for the products and others wrote incorrect formulae such as MgCu, SO<sub>4</sub> and MgCuSO<sub>4</sub>.

(b) Weaker candidates did not read the question carefully enough. The position of chromium *compared* to the other *four* metals was required to gain credit. Common incomplete answers included:

- chromium is very reactive
- chromium is more reactive than iron
- chromium is less reactive than zinc
- chromium is above iron.

(c) Surprisingly poorly answered. This is a familiar question on the Foundation Tier paper but many candidates used 30°C (the value for chromium) although **iron** was in bold in the question. The equation given included units to help candidates choose the correct values but this did not help all. Even when candidates chose the three correct values multiplication errors were seen. Other common errors were:

- using the mass of 0.5 instead of the volume 50 in the equation
- using an incorrect temperature value from the table.

Q.6 The QER question was better answered than in previous years which might be because the topic was well within the grasp of foundation tier candidates. However, as in previous years, the standard of handwriting, spelling and grammar were often poor.

There were two parts to the question. Firstly, the candidate needed to describe the meaning of the pH scale, namely that the:

- pH scale measures acid/alkali strength
- strength of acids increases from pH 6 to 1
- strength of alkalis increases from pH 8 to 14
- pH 7 represents a neutral solution

The second part involved describing what the pH shows relating to the four substances given e.g. battery acid is red/pH 1 therefore it is a strong acid.

Answers should be logically structured, easily understood and contain no irrelevant material. Candidates would benefit from spending a minute or two planning their answer rather than writing each point separately as they think of them.

It was pleasing to see that almost all candidates attempted the question which is an improvement from previous years.

**Q.7** This PISA-style question was generally well answered.

- (a) (i)&(ii) Well answered.
- (b) (i) Most candidates gained two of the available marks for plotting the points correctly. Many did not attempt to draw a curve of best fit.
- (ii) Well answered. The most common incorrect answer was 4 hours.
- (iii) This question was only answered correctly by the more able foundation tier candidates. The most common incorrect answer was 'Heat formed expands the iron'.

**Q.8** This question was not well answered by Foundation Tier candidates.

- (a) (i) If a candidate gained credit, it was likely to be for identifying the incorrect charge on the potassium ion. Many candidates lost marks by not reading the question carefully. There were only two mistakes in the student's answer but some identified three or even four mistakes. Two correctly identified mistakes and two other suggestions gained no marks.
  - (ii) The information in the question refers to 'charges on the ions' but many candidates named the type of bonding as covalent. Weaker candidates did not know what was being asked. These gave answers such as 'chemical', 'potassium fluoride', 'halogen' and 'green'.
  - (iii) Able foundation tier candidates gained this mark. However, weaker candidates chose **A** or **B**.
- (b) Weaker candidates struggled with this covalent bonding question.

**Q.9** This question was poorly answered, especially part (a)(iv).

- (a) (i) Most Foundation Tier candidates do know the meaning of the term 'raw material' in this context. Incorrect answers included 'water', 'ammonia', 'ammonium', 'iron ore', 'sulfur', 'heat', 'methane' and 'crude oil'.
  - (ii) Most Foundation Tier candidates did not understand what was required in this question. Incorrect answers referred to the yield of ammonia e.g. 'no more ammonia will be made'.
  - (iii) This question was well answered. Incorrect answers included 'vanadium(V) oxide' and 'iron'.
  - (iv) It is evident from this question that most Foundation Tier candidates do not really understand what information is shown in a chemical equation.
- (b) Poorly answered.
- (c) Poorly answered. The most common incorrect answer was 3.

**Q.10** This question was poorly answered.

- (a) (i) Most candidates gained this mark however very few could correctly 'electrolysis'.
- (ii) Very few candidates gained this mark. All four boxes appeared to be randomly chosen.
- (iii) Poorly answered. Very few Foundation Tier candidates could write the formula for either compound.
- (b) The most able Foundation Tier candidates gained this mark. Weaker candidates copied four metals from part (a) into the spaces.

### Summary of key points

- Understanding chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 12 marks were awarded for these skills on this paper.
- Basic numerical skills such as addition, subtraction, multiplication and graphical skills are essential in all chemistry papers. Approximately 15% of marks each paper are classified as 'mathematical'.
- Invest time in developing good understanding of bonding. It is one of the topics assessed on every paper.

**CHEMISTRY**  
**GCSE**  
**Summer 2022**  
**UNIT 2 – HIGHER TIER**

**General Comments**

There were a small but significant number of candidates who would have benefitted from being entered for the Foundation Tier paper. Many marks were lost throughout the paper by candidates either not reading questions carefully or simply not understanding what was being asked of them. Higher Tier candidates performed well on the common questions.

Candidates demonstrated a good knowledge and understanding of the following areas of the specification:

- bonding
- Haber process
- reactivity series
- bond energy calculations
- organic chemistry.

Candidates demonstrated a lack of knowledge and understanding in the following areas:

- writing chemical formulae
- oxidation in terms of loss of electrons
- strong and weak acids
- chemical analysis.

**Comments on individual questions/sections**

**Q.1** Overall this question on bonding was well answered.

- (a)**
  - (i)** Well answered.
  - (ii)** Well answered.
  - (iii)** Most candidates gained this mark but **A** and **B** were commonly seen incorrect answers.
- (b)** Generally well answered.

**Q.2** Although this question was fairly well answered it saw the lowest facility factor of the common questions on the Higher Tier paper.

- (a)**
  - (i)** Many candidates failed to gain this mark. There was poor understanding of the term 'raw material'. Common incorrect answers included 'oxygen' and 'sulfur'.
  - (ii)** Well answered.
  - (iii)** Well answered.

- (iv) Surprisingly poor answered. Many candidates did not understand that '2NH<sub>3</sub>' represents two ammonia molecules.
- (b) Generally well answered. The most common incorrect answer was **C**.
- (c) Generally well answered. Weaker candidates simply used the subscript 3 from NH<sub>3</sub>.
- Q.3** All parts except (a)(iii) were generally well answered.
- (a) (iii) Only the more able candidates scored all three marks for this question. Many failed to give the formula for copper(II) oxide and the full range of incorrect formulae was seen including Cu<sub>2</sub>, CuO<sub>2</sub> and Cu<sub>2</sub>O and AlO, AlO<sub>3</sub> and Al<sub>2</sub>O for aluminium oxide.
- Q.4** Only the weakest candidates failed to gain most of the marks for this question.
- (a) The most common error was dividing 1856 by 2 instead of by 4.
- (b) The most common error was in doubling 436.
- (c) Only the weakest candidates failed to gain this mark.
- Q.5** Generally well answered. Weaker candidates struggled with the recall required in some parts.
- (a) (i) Most candidates gained the mark for process **B** (filtration). Fewer gained the mark for process **C** (fractional distillation) and only the more able named process **A** (fermentation). Common incorrect answers included electrolysis and neutralisation for process **A** and cracking and polymerisation for process **C**.
- (ii) I. The most common incorrect answer was 'add bromine water'.  
II. Following on from part I. the most common incorrect answer was 'orange to colourless'.
- (b) (i)&(ii) Pleasingly, these questions were well answered with many candidates gaining both marks.
- (c) (i)&(ii) Most candidates gained both marks for this question where a good range of answers were accepted.
- Q.6** In previous papers, questions on organic chemistry have not been answered well. Pleasingly this year was the exception. The different question style in part (c) may explain this.
- (a) (i)&(ii) Well answered.
- (b) Well answered by the more able candidates. Weaker candidates struggled and simply re-shaped one of the given structures. Some included two C=C double bonds and/or more than four carbon atoms.
- (c) (i) Well answered.

- (ii)
  - I. Generally well answered.
  - II. Only answered correctly by more able candidates. The most common incorrect answer was 1,2-dibromoethene.
- (d)
  - (i) Well answered. Many candidates stated that it should be buried in the ground showing their lack of understanding of the term 'landfill'.
  - (ii) The raw material used to make polyethene was not well known. Coal and natural gas were not credited, however, candidates who gave any fossil fuel were able to gain the second mark with a correct response.

**Q.7** This PISA-style question was well answered except for part (b).

- (a) Well answered. Some weaker candidates did not read the question carefully and ticked either one or three boxes.
- (b) Many candidates were not able to interpret the equation in model form from the diagram. The model of oxygen in the diagram is made up of two oxygen atoms, however, many candidates put 'O' instead of O<sub>2</sub> in the equation. Similarly, only able candidates were able to correctly interpret the model of methanol. The correct formulae for the missing reactant and the product were needed to access the balancing mark.
- (c) Well answered.

**Q.8** (a) It is assumed that Higher Tier candidates are able to correctly rearrange a simple mathematical equation. Many failed to do so. Others lost a mark because they failed to realise that the energy given out was  $8.4 \times 10^4$  or 84000 J.

- (b) Weaker candidates completely failed to deal with the units on the x-axis.
- (c) Most candidates gained one of the two available marks for stating a qualitative relationship e.g. 'as the mass increases, the energy increases'. Only the more able candidates gained the second mark by stating that mass and energy are directly proportional. Use of less specific mathematical terms was credited as a 1-mark answer e.g. 'mass and energy are positively correlated'.
- (d) Generally well answered. Most candidates identified the use of a lid to reduce heat transfer to the surroundings.

**Q.9** This question was not well answered.

- (a)
  - (i) A vague reference to a coloured solution was not credited. Candidates were required to state that a 'colour change' would be seen.

- (ii) I. Once again this symbol equation was poorly done, and once again candidates didn't help themselves by not reading the question carefully. They are told that iron reacts with iron(III) chloride to make iron(II) chloride but many added  $\text{Cl}_2$  to the equation. Only the able candidates gained any marks for this question.
- II. Unless candidates scored one mark in part I. they had little or no chance to gain both marks available for this question. Able candidates managed to gain the first mark by stating that oxidation is a 'loss of electrons'. Very few were able to state that the iron atom lost two electrons to form  $\text{Fe}^{2+}$  ions.
- (b) This recall question was poorly answered. The most common incorrect reagents included bromine water, silver nitrate and barium chloride. The second mark was only credited if the correct reagent was given.
- Q.10** (a) (i) The concentration/moles/volume equation was given to help candidates but many simply substituted values without changing the volume into  $\text{dm}^3$  resulting in the loss of one mark.
- (ii) The instructions clearly stated that the equation for the reaction should be used in this part of the question. Many candidates tried used the equation given in part (i) and subsequently got a wrong answer.
- (iii) The error carried forward principle benefited many candidates in this part of the question.
- (b) (i) Some candidates made vague references to 'temperature' rather than 'temperature change' in the first part of their answer. In the explanation some lost credit for referring to the reactivity of the two acids rather than their relative strength or degree of dissociation.
- (ii) I. Few candidates correctly named the salt as copper(II) ethanoate.  
II. Only the more able obtained this mark.
- Q.11** The QER question was better answered than in previous years. This may be because much of the recall material needed was given in the question and diagram. Simply restating what was already given gained no credit.

The chemistry content of this question can be divided into three parts. Candidates had to address the formation of hydrogen, chlorine and sodium hydroxide.

Their overall performance was often affected by their ability to:

- use correct scientific terminology e.g. differentiating between ions and atoms
- structure their accounts logically
- include only relevant information.

### Summary of key points

- Writing chemical formulae and equations are important skills in chemistry and should be practised regularly throughout the course. A total of around 10 marks were awarded for these skills on this paper.
- Read questions very carefully paying particular attention to information given to help with the answer.
- Take a short time to plan your answer to the QER question before beginning to write. Consider the scientific terminology that should be included and the order in which to make your points. Ensure that your answer is as concise and relevant as possible.

**CHEMISTRY**

**GCSE**

**Summer 2022**

**UNIT 2 (CONTINGENCY) – FOUNDATION TIER**

**General Comments**

Too few candidates sat this paper to enable a meaningful report to be written.

# CHEMISTRY

## GCSE

Summer 2022

### UNIT 2 (CONTINGENCY) – HIGHER TIER

#### General Comments

Fewer than 20 candidates sat this paper, but a brief summary report follows.

#### Comments on individual questions/sections

- Q.1** This question based on the fractional distillation of crude oil, the cracking of hydrocarbons and the fire triangle was generally well answered.
- Q.2** The raw materials needed for the contact process were not known by most candidates.
- The question relating to the dehydration of sugar was poorly answered. Candidates were unable to give the two products although the formula of sugar was given together with a picture showing a black mass and gas/vapour being formed. Incorrect answers included 'sulfur', 'sugar' and 'sulfur dioxide'. Most candidates stated that the process taking place was 'exothermic' although the term 'exothermic' was used in the question.
- Q.3** The equations for the reactions used to make salts were completed correctly by most candidates. Unfortunately, many could not recall the practical details relating to the isolation of an insoluble salt nor the stages involved in the preparation of a soluble salt using the titration method. The latter is a standard experiment and regularly examined.
- Q.4** Questions relating to both ionic and covalent bonding were generally well answered. However, the QER question which required knowledge and understanding of metallic and ionic structures was extremely poorly attempted. Most candidates attempted to describe the bonding in calcium chloride and some described the conductivity in both substances in terms of electrons being free to move. As in previous examinations the answers showed a lack of planning.
- Q.5** There was a lack of detailed knowledge relating to the electrolysis of aluminium oxide with many vague and poorly expressed answers seen. The PISA-style question relating to the electrolysis of brine was well answered.
- Q.6** Even when provided with the molecular formulae of the first four members of the homologous series, most candidates could not give the general formula for alcohols. Many did not use the molecular formula for ethanol given in the question to complete the equation for fermentation. Only a few candidates gained credit in the questions on the structure and naming of alcohols.
- Q.7** All candidates gained credit for the plotting of a graph using difficult scales. Most demonstrated good understanding in the use of graphs. However, once again basic knowledge of practical work was poor.

As in previous years only the more able candidates gained any credit for the calculations involving moles and concentration. Most were able to calculate the relative molecular mass of copper(II) sulfate. However, very few were able to convert mass to moles or calculate the concentration of a solution, even when provided with the relevant equation. Very few candidates converted  $500 \text{ cm}^3$  to  $0.5 \text{ dm}^3$ .

- Q.8** Most candidates coped well with the bond energy calculation but fewer were able to apply their knowledge in the less familiar part of the question. Most candidates were able to interpret data given in a complex table.

As in previous years the chemical analysis question was poorly answered. It appears that candidates are unable to learn the reagents used and the results expected during tests for the handful of ions required by the specification.

### Summary of key points

- Think carefully about what is happening as each step of a practical method is carried out and how the task is related to the theory.
- Read questions very carefully paying particular attention to information given to help with the answer.
- Take a short time to plan your answer to the QER question before beginning to write. Consider the scientific terminology that should be included and the order in which to make your points. Ensure that your answer is as concise and relevant as possible.



WJEC  
245 Western Avenue  
Cardiff CF5 2YX  
Tel No 029 2026 5000  
Fax 029 2057 5994  
E-mail: [exams@wjec.co.uk](mailto:exams@wjec.co.uk)  
website: [www.wjec.co.uk](http://www.wjec.co.uk)