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# General Certificate of Secondary Education

# Additional Science 4463 / Chemistry 4421

## CHY2H Unit Chemistry 2

# Mark Scheme

*2012 examination - January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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# MARK SCHEME

## Information to Examiners

### 1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

### 2. Emboldening

**2.1** In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

**2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.

**2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

### 3. Marking points

#### 3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

| Student | Response | Marks awarded |
|---|---|---|
| 1 | 4,8 | 0 |
| 2 | green, 5 | 0 |
| 3 | red*, 5 | 1 |
| 4 | red*, 8 | 0 |

Example 2: Name two planets in the solar system. (2 marks)

| Student | Response | Marks awarded |
|---|---|---|
| 1 | Pluto, Mars, Moon | 1 |
| 2 | Pluto, Sun, Mars, Moon | 0 |

### 3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

### 3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

### 3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

### 3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

### 3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

### 3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

**CHY2H**

**Question 1**

| question | answers | extra information | mark |
|---|---|---|---|
| **1(a)** | any **one** from:<br>• no method / electrolysis / equipment / technology<br>• aluminium is a very reactive metal<br>• high melting point<br>• potassium had not been discovered | <br>allow 'didn't know how to' **or** 'no knowledge'<br><br><br>allow 'couldn't heat it enough' | 1 |
| **1(b)** | because others / scientists / they could not repeat the experiment **or** others / they could not obtain the same results | ignore he could not repeat the experiment | 1 |
| **1(c)** | reaction is endothermic **or** reaction takes in heat / energy | accept activation energy<br>ignore rate / high temperature<br>ignore bonds broken | 1 |
| **1(d)** | (aluminium chloride + potassium) → aluminium + potassium chloride | in either order<br>accept correct formulae<br>ignore metal<br>ignore balancing | 1 |
| **1(e)** | when tested it had the properties of a metal<br><br>properties were different (from other known metals) | accept a test for a metal property eg conductivity / reaction with acid<br><br>accept properties compared with other metals | 1<br><br>1 |
| **Total** | | | **6** |

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**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| **2(a)(i)** | 40 | correct answer with or without working **or** incorrect working<br><br>if the answer is incorrect then evidence of 24 + 16 gains **1** mark<br><br>ignore units | 2 |
| **2(a)(ii)** | 60 | correct answer with or without working **or** incorrect working<br><br>if the answer is incorrect then evidence of 24/40 **or** 24/(i) gains **1** mark<br><br>ecf allowed from part(i)<br>ie 24/(i) x100<br><br>ignore units | 2 |
| **2(a)(iii)** | 15 | ecf allowed from parts(i) and (ii)<br><br>24/(i) x 25 or (ii)/100 x 25<br><br>ignore units | 1 |
| **2(b)(i)** | any **two** from:<br><br>• error in weighing magnesium / magnesium oxide<br><br>• loss of magnesium oxide / magnesium<br><br>• not all of the magnesium has reacted | ignore gas is lost<br><br>allow some magnesium oxide left in crucible<br><br>allow they lifted the lid too much<br>allow loss of reactants / products<br><br>allow not heated enough<br>allow not enough oxygen / air | 2 |

**Question 2 continues on the next page……**

**CHY2H**

**Question 2 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **2(b)(ii)** | any **two** from:<br>• check that the result is not anomalous<br>• to calculate a mean / average<br>• improve the reliability<br>• reduce the effect of errors | ignore fair test<br><br>allow improve the accuracy of the mean / average<br>allow make it reliable | 2 |
| **Total** | | | **9** |

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**Question 3**

| question | answers | extra information | mark |
|---|---|---|---|
| **3(a)** | 2.8.2 (drawn as dots or crosses on the circles)<br><br>2.8.8 (drawn as dots or crosses on the circles) | ignore any attempts to change the charge on chloride ion<br><br>accept e instead of dots or crosses | 1<br><br>1 |
| **3(b)(i)** | filtration | accept decanting or centrifugation<br><br>do **not** accept evaporation | 1 |
| **3(b)(ii)** | hydrochloric | accept HCl | 1 |
| **3(c)(i)** | so that ions / particles can move (in electrolyte) | allow so it can conduct electricity / carry charge / carry current<br><br>ignore reference to electrons moving in the external circuit<br><br>any unqualified reference to electrons moving / carrying charge / carrying current = **0** marks | 1 |
| **3(c)(ii)** | electrons are lost | ignore numbers | 1 |
| **3(c)(iii)** | + $2e^-$ on left hand side of equation | must be correct with no other additions<br>accept correct multiples | 1 |
| **Total** | | | **7** |

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**Question 4**

| question | answers | extra information | mark |
|---|---|---|---|
| **4(a)(i)** | | mention of molecules / intermolecular / ionic / covalent = **max 2** | |
| | atoms / positive ions | | 1 |
| | any **two** from: | | 2 |
| | • (atoms / positive ions) in regular pattern / lattice / layer / giant structure (or diagram) | | |
| | • delocalised electrons | accept electrons move within / through the structure<br>allow free (moving) electrons<br>allow sea of electrons | |
| | • (atoms / positive ions) held together by strong / electrostatic attractions | allow strong (metallic) bonds | |
| **4(a)(ii)** | delocalised electrons | accept electrons move within / through the structure<br><br>allow free electrons | 1 |
| **4(b)(i)** | smaller / very small | accept converse<br><br>accept 1 – 100 nanometres in size<br><br>accept a few hundred atoms<br><br>accept larger surface area **or** large surface area for their size | 1 |
| **4(b)(ii)** | nanoparticles / more can fit into (tiny) gaps | allow nanosize particles have large(r) surface area | 1 |
| **Total** | | | **6** |

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**Question 5**

| question | answers | | extra information | mark |
|---|---|---|---|---|
| **5** | 70/56 | 30/16 | division by atomic mass | 1 |
| | = 1.25 | = 1.875 | proportion | 1 |
| | 2 | 3 | ratio (accept 1:1.5 / 4:6 / etc)<br>allow e.c.f from proportion if sensible attempt at step 1 | 1 |
| | $Fe_2O_3$ | | formula allow e.c.f from ratio if sensible attempt at step 1<br>allow correct formula with no working = **1** mark | 1 |
| **Total** | | | | **4** |

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**Question 6**

| question | answers | extra information | mark |
|---|---|---|---|
| **6(a)** | covalent | | 1 |
| **6(b)(i)** | 2 molecules / particles on the left (of the equation) and one on the right<br><br>**or**<br><br>2 volumes on the left and one on the right<br><br>**or**<br><br>the reaction results in a decrease in the number of molecules | allow the reaction moves in the direction which opposes the increase in pressure<br><br>ignore reference to rate / collisions / exothermic | 1 |
| **6(b)(ii)** | the (forward) reaction is exothermic **or**<br>the reverse / backward reaction is endothermic | allow the reaction moves in the direction which opposes the increase in temperature | 1 |
| **6(c)** | because particles / molecules are closer together<br><br>so collisions are more frequent **or** (particles) collide more often | accept increases the concentration<br>do **not** accept atoms / electrons<br><br>ignore collide faster / quicker **or** more successful collisions<br><br>do **not** accept particles have more energy or move faster | 1<br><br>1 |

**Question 6 continues on the next page……**

**CHY2H**

**Question 6 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **6(d)** | forces of attraction / bonds between molecules are weak<br><br>**or**<br><br>intermolecular forces / bonds are weak | accept it is made of small molecules with weak forces of attraction for **2** marks<br><br>do **not** accept intramolecular forces / covalent bonds are weak<br><br>do **not** accept reference to ions<br><br>do **not** accept intermolecular forces between atoms<br><br>if 2 marks not awarded<br><br>made of small molecules / simple molecular gains **1** mark<br><br>forces of attraction are weak (without specifying between molecules / intermolecular) gains **1** mark<br><br>ignore bonds are weak | 2 |
| **Total** | | | **7** |

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**Question 7**

| question | answers | extra information | mark |
|---|---|---|---|
| **7(a)(i)** | | ionic / molecules / metallic / (inter)molecular = max **2** | |
| | because graphene / it has a giant structure / lattice / macromolecular | accept all / every / each atom is bonded to 3 other atoms | 1 |
| | because graphene / it has covalent bonds / is covalent | | 1 |
| | because in graphene / it the bonds are strong **or** a lot of energy needed / hard to break the bonds | | 1 |
| **7(a)(ii)** | there are delocalised / free electrons | | 1 |
| | because one (delocalised / free) electron per atom linked to first marking point | accept because three electrons per atom used (in bonding)<br><br>accept because one electron per atom not used (in bonding) | 1 |
| **7(b)** | opaque (owtte)<br>**or** layers slide<br>**or** layers not aligned | eg could not see through them<br><br>ignore thick | 1 |
| **Total** | | | **6** |

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