



# **General Certificate of Secondary Education**

## **Chemistry 4421**

**CHY3F            Unit Chemistry 3**

## **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.

**CHY3F****Question 1**

| <b>question</b> | <b>answers</b>                     | <b>extra information</b>                          | <b>mark</b> |
|-----------------|------------------------------------|---|-------------|
| <b>1(a)</b>     | groups                             |   | 1           |
| <b>1(b)</b>     | it is a non-metal                  | allow it is not a metal                           | 1           |
| <b>1(c)</b>     | to the right of column 7 / Group 7 | accept in Group 0<br>ignore Group 8 / noble gases | 1           |
| <b>1(d)</b>     | (atomic) number                    | allow proton number                               | 1           |
| <b>Total</b>    |                                    |   | <b>4</b>    |

**Question 2**

| <b>question</b>  | <b>answers</b>   | <b>extra information</b>  | <b>mark</b> |
|------------------|--|---|-------------|
| <b>2(a)(i)</b>   | evaporated   |   | 1           |
| <b>2(a)(ii)</b>  | condensed  |   | 1           |
| <b>2(a)(iii)</b> | dissolved  |   | 1           |
| <b>2(a)(iv)</b>  | filtered<br>sterilised   |   | 2           |
| <b>2(b)(i)</b>   | scum forms   | accept does not form a lather<br>do <b>not</b> accept scale forms | 1           |
| <b>2(b)(ii)</b>  | calcium ions   |   | 1           |
| <b>2(c)(i)</b>   | straight line through all the points<br>except the point at 20°C |   | 1           |
| <b>2(c)(ii)</b>  | value in the range 50 - 51                                       |   | 1           |
| <b>2(c)(iii)</b> | increases  |   | 1           |
| <b>Total</b>     |  |   | <b>10</b>   |

**CHY3F****Question 3**

| <b>question</b> | <b>answers</b>                   | <b>extra information</b> | <b>mark</b> |
|-----------------|----------------------------------|--------------------------|-------------|
| <b>3(a)</b>     | sodium has a lower density       |                          | 1           |
|                 | sodium is more reactive          |                          | 1           |
| <b>3(b)</b>     | hydrogen                         |                          | 1           |
| <b>3(c)</b>     | $\text{OH}^{\ominus}(\text{aq})$ |                          | 1           |
| <b>Total</b>    |                                  |                          | <b>4</b>    |

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## Question 4

| question     | answers  | extra information  | mark      |
|--------------|--|--|-----------|
| 4(a)         | it / brown colour has a high(er) boiling point   | allow it / brown colour is a solid                         | 1         |
| 4(b)(i)      | partially  |  | 1         |
| 4(b)(ii)     | for ethanoic acid –<br><br>fewer bubbles <b>or</b> gas produced at a slower rate       | accept converse points for hydrochloric acid               | 1         |
|              | more magnesium remains <b>or</b> magnesium disappears more slowly                      |  | 1         |
| 4(c)(i)      | pipette<br><br>conical flask<br><br>burette  | answers must be in the order shown                         | 1         |
|              |  |  | 1         |
|              |  |  | 1         |
| 4(c)(ii)     | indicator<br><br>colour changes  | if indicator named then any stated colours must be correct | 1         |
|              |  |  | 1         |
| 4(d)(i)      | 23.5 is anomalous / rough titration / overshoot<br><br>the mean of the other 3 is 20.0 |  | 1         |
|              |  |  | 1         |
| 4(d)(ii)     | (no)<br><br>it only contained 4.8g of ethanoic acid in 100cm <sup>3</sup>              |  | 1         |
| <b>Total</b> |  |  | <b>12</b> |

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## Question 5

| question  | Answers  | extra information   | mark |
|-----------|--|---|------|
| 5(a)(i)   | A  |   | 1    |
| 5(a)(ii)  | B  |   | 1    |
| 5(b)(i)   | put a lid on (beaker)<br><b>or</b><br>insulate (top or sides of) beaker<br><br><b>or</b><br>use screens to prevent draughts  | any addition to the equipment that would prevent energy loss<br><br>allow bomb calorimeter<br>do <b>not</b> allow polystyrene cup<br>ignore 'move the crucible'   | 1    |
| 5(b)(ii)  | (temperature change =) 22°C  | correct answer is <b>2</b> marks with or without working  | 1    |
|           | (100 x 4.2 x 22 =) 9240  | allow ecf from their 22   | 1    |
| 5(b)(iii) | any <b>two</b> from: <ul style="list-style-type: none"> <li>a <u>specified</u> human/measurement error</li> <li>water should be stirred</li> <li>not all of the glucose burns</li> <li>energy used to heat the beaker / container</li> <li>recorded the room temperature (at the beginning)</li> </ul> | ignore 1g of glucose insufficient<br>ignore 100cm <sup>3</sup> of water too much<br>ignore calculation error<br>ignore not repeated / anomalous results<br><br>allow thermometer in fixed position<br><br>allow glucose was impure<br><br>ignore light energy / evaporation<br><br>allow room temperature was <u>higher</u> /different to the temperature of the (cold) water<br>allow did not measure the water temperature at the beginning | 2    |



**Question 5 continued . . .**

| <b>question</b> | <b>Answers</b>  | <b>extra information</b>   | <b>mark</b> |
|-----------------|---|--|-------------|
| <b>5(c)</b>     | any <b>one</b> from: <ul style="list-style-type: none"><li>• for dietary information</li><li>• <u>different</u> foods produce different amounts of energy</li><li>• legal requirement</li></ul> | allow consequences of diet<br>allow for nutritional information<br>allow eat healthily<br>ignore balanced diet<br>ignore to know how much energy is taken in | <b>1</b>    |
| <b>Total</b>    |   |  | <b>8</b>    |

**CHY3F****Question 6**

| <b>question</b> | <b>Answers</b>                            | <b>extra information</b>   | <b>mark</b> |
|-----------------|---|--|-------------|
| <b>6(a)(i)</b>  | carbon dioxide / CO <sub>2</sub>          | answers must be in the order shown   | 1           |
|                 | carbonate / CO <sub>3</sub> <sup>2-</sup> | marks are independent  | 1           |
| <b>6(a)(ii)</b> | ammonia / NH <sub>3</sub>                 | answers must be in the order shown   | 1           |
|                 | litmus                                    | marks are independent  | 1           |
| <b>6(b)(i)</b>  | solution is blue                          | accept blue precipitate only if sodium hydroxide added<br><br>allow blue liquid<br><br>allow copper sulfate / copper ions are blue | 1           |
| <b>6(b)(ii)</b> | barium chloride / BaCl <sub>2</sub>       | allow barium nitrate / barium ions / Ba <sup>2+</sup>  | 1           |
|                 | white                                     | answers must be in the order shown<br><br>marks are independent  | 1           |
| <b>Total</b>    |   |  | <b>7</b>    |

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