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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Chemistry 4421

CHY3H Unit Chemistry 3

Mark Scheme

2009 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 candidates' 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 candidates' 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.

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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 candidates 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)

Candidate	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)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate 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.

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
1(a)(i)	hydrochloric acid / HCl carbon dioxide / CO_2	accept any (named) acid accept bubbles / fizz / gas **or** limewater gets milky ignore 'add limewater' do **not** accept other named gases 2nd mark dependant on first mark accept for this answer only heat gives CO_2 / limewater milky = **1** mark	1 1
1(a)(ii)	(white) precipitate / solid	ignore names of substances even if incorrect accept white deposit / substance do **not** accept any coloured precipitate	1
1(a)(iii)	eg flame colour of (Na) and flame colour of (K) interfere / mask / mix with each other	accept 'can't see the colours' **or** 'difficult to determine the colour' **or** 'both produce different colours' **or** a correct statement of colours **or** hard to distinguish	1
1(b)(i)	eg essential (mineral) **or** everyone needs it / some (salt) **or** problems with health if have no salt	accept preservative / flavouring / taste it = salt (all) foods contain / use it / sodium chloride / salt	1

Question 1 continued on the next page...

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

Question 1 continued...

question	answers	extra information	mark
1(b)(ii)		mark positively ie no list principle	
	advantages		2
	any **two** from: • more people will be healthier • (should have) less heart disease • (should have) less cancer • (more people with) lower blood pressure	ignore economic arguments throughout **or** people eat less salt	
	disadvantages		1
	any **one** from: • not everyone affected • not enough evidence • does not provide choice • undemocratic • less taste / flavour • shorter shelf life / not preserved (as long) • too much potassium chloride might be bad	ignore references to too much / too little (salt) ignore no flavour / taste ignore references to sell by dates	
Total			**8**

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
2(a)	eg plastic (beaker) / insulation / lid / cover **or** any mention of enclosed	any sensible modification to reduce heat loss ignore prevent draughts ignore references to gas loss	1
2(b)	all the substances react **or** all (the substances) react fully / completely **or** heat evolved quickly **or** distribute heat	accept to mix them 'so they react' is insufficient for the mark accept increase chances of (successful) collisions / collision rate increase do **not** accept rate of reaction increase / make reaction faster	1
2(c)	experiment 2 **and** different / higher / initial / starting temperature	accept experiment 2 **and** the room is hotter / at higher temperature do **not** accept temperature change / results higher	1
2(d)	temperature change does not fit pattern	accept anomalous / odd **or** it is the lowest **or** it is lower than the others **or** it is different to the others 'results are different' is insufficient	1
2(e)	7 / 7.0		1
2(f)	(100 × 4.2 × 7) = 2940	ecf from (e)	1
2(g)	diagram A **and** reaction exothermic / heat evolved / Δ H is negative / temperature rises	accept energy is lost (to the surroundings)	1
Total			**7**

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
3(a)		starting point of description does not have to start with evaporation references to steam / boiling max **2** marks	
	evaporation	accept liquid turns to vapour	1
	condensation	accept vapour turns into liquid 'cloud forms' is insufficient	1
	any **one** from: • (evaporation) by sun • water vapour / clouds rise / cool • water falls as rain / snow / hail / sleet / "precipitation" • water flows from river to the sea		1
3(b)(i)	calcium (ion) / Ca^{2+}	ignore any formula if ion only must be correct accept magnesium (ion) / Mg^{2+} do **not** accept named compounds	1
3(b)(ii)	contact with rocks	accept named rocks ignore ground / deposits / soil / minerals / ores	1
	(ions / substances) dissolved / soluble / leached / reacts	ignore erode / corrode / picks up / absorb	1
3(b)(iii)	(ions / substances / they) react / replace / remove	accept displace	1
	forms precipitate / insoluble / solid	if ion exchange (column) = max **1** mark	1
Total			**8**

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
4(a)	40 (Ca) + 137 (Ba) ÷ 2 = 88.5	accept a recognition that the average is near 88 **or** it is the average of the other two accept Sr is midway between Ca and Ba	1
4(b)	eg newly discovered elements / atoms didn't fit (into triads) **or** didn't apply to all elements / atoms **or** lot of exceptions	he = Döbereiner ignore Mendeleev left spaces **or** not enough evidence	1
4(c)	any **two** from: • fizzes / bubbles / gas • violent / vigorous / explodes / very fast reaction • floats / on surface • moves (very quickly) • melts (into a ball) • bursts into flame • gets smaller / (reacts to) form a solution / dissolves / disappears etc • steam / gets hot (owtte)	 hydrogen alone is insufficient ignore incorrect name if 'gas' stated accept container explodes ignore strong reaction ignore sinks accept (bright) light ignore colour / glow ignore alkaline solutions **or** change in colour etc	2
4(d)(i)	same number of electrons in outer shell	accept energy level for shell accept a correct reference to a specific group eg (all) have one electron in outershell / (all) lose one electron (when they react)	1

Question 4 continues on the next page...

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

Question 4 continued...

question	answers	extra information	mark
4(d)(ii)	electrons fill an inner / 3rd shell	accept energy level for shell accept d-level being filled accept specific reference to 3rd shell accept descriptions in terms of 3d & 4s etc	1
	(usually) same number of outer / 4th shell electrons		1
4(d)(iii)		it = lithium accept energy level for shell **or** converse reasoning for potassium	
	outer shell electron closer to nucleus	accept fewer shells / smaller atom	1
	more (electrostatic) attraction (to nucleus) / electrons less likely to be lost	accept less shielding / isn't much shielding ignore nucleus has more influence but accept nucleus has more influence over the outer electron(s) do **not** accept magnetic / gravitational attraction	1
Total			**9**

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
5(a)(i)	(HCl / acid has) hydrogen ions / H^+	accept H ions do **not** accept H^- / protons / proton donor	1
5(a)(ii)	(NaOH / base / alkali has) hydroxide ions / hydroxyl ions / OH^-	accept OH ions do **not** accept proton acceptor	1
5(a)(iii)	equal numbers of H^+ and OH^- **or** H^+ cancel OH^- out	accept (H_2O) contains H^+ and OH^- accept $H^+ + OH^- \rightarrow H_2O$ accept H^+ has neutralised OH^- **or** converse ignore ionic charge is balanced ignore acid and basic species equal	1
5(b)	proton donor	ignore base / alkali is a proton acceptor	1
5(c)	any **one** from the following ideas: • no previously (proven) theory of ion formation • not enough evidence / not enough proof / lack of information • lack of communication / technology • his (scientific) reputation questioned **or** not regarded highly • ideas ahead of his time / subatomic particles not known	 accept 'he thought of it first' ignore no evidence / proof accept evidence increased over time ignore he spoke a foreign language ignore 'because he was young / a student' accept his ideas did not work for ammonia (gas)	1
Total			**5**

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

question	answers	extra information	mark
6(a)	bromine (water) / Br_2	accept iodine / I_2	1
	decolourised / goes (from orange / red brown/ brown / yellow) colourless	dependent on first mark ignore goes clear / discoloured do **not** accept wrong colours	1
6(b)	(smell) warns of a leak / gas escape	accept leak / gas escape by implication ignore smell alone	1
6(c)	eg (mass spectrometry gives) different molecular ions / *M*r / formula mass **or** shows that one has mass 44 and the other 58	' mass of butane is more than mass of propane' is insufficient accept different fragmentation / pattern do **not** accept A_r / RAM accept references to butane deflects less or converse	1

Question 6 continued on the next page...

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: January 2009

Question 6 continued...

question	answers	extra information	mark
6(d)			max 4
	CO_2 $2\,H_2O$ $\frac{1.1}{44}$ $\frac{0.9}{18}$		1
	= 0.025 = 0.05		1
	1 (mole) CO_2 2 (moles) H_2O		1
	1 4		1
	or		
	CH_4		
	or alternative method		
	Mass of C = $\frac{12}{44}$ x 1.1 = 0.3g (1)		
	Mass of H = $\frac{2}{18}$ x 0.9 = 0.1g (1)		
	C : H $\frac{\text{mass}}{M_r}$ $\frac{0.3}{12} : \frac{0.1}{1}$		
	proportions 0.025 : 0.1 (1)		
	whole number 1 : 4 (1)		
	or		
	CH_4	correct formula with no working is only 1 mark M3 can be awarded from the formula if steps one and two are clear correct formula from their incorrect ratio gets 1 mark if fraction is wrong way around e.g. M_r / mass, then lose M1 and M2 but accept ecf for M3 and M4	
Total			**8**