GCSE
ADDITIONAL SCIENCE / CHEMISTRY

CH2HP
Mark scheme

4408 / 4402
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Version: 1.0 Final

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

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.

Further copies of this Mark Scheme are available from aqa.org.uk

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 Assessment Objectives and specification content that each question is intended to cover.

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 and underlining

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 bullet points 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.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 2 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding (for a C grade), supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
1(a)(i)	(phosphoric) acid	*allow phosphoric*	1	2 / 2.6.2d	G
1(a)(ii)	H^+ / hydrogen (ion)	*if ion symbol given, charge must be correct*	1	2 / 2.6.2d	E
1(b)(i)	pencil so it will not run / smudge / *dissolve* **or** because ink would run / smudge / *dissolve*	 *ignore pencil will not interfere with / affect the results* *ignore ink will interfere with / affect the results*	1 1	2 / 2.3.2b	E
1(b)(ii)	any **three** from: • *3* colours in Cola • *2* colours in Fruit drink • one of the colours is the same • two of the colours in Cola are different • one of the colours in Fruit drink is different • *one of the colours in Cola is the most soluble*	*reference to spots / dots = max **2*** *allow colouring for colour* *allow more colours in cola **or** fewer colours in fruit drink* *allow some of the colours in the drinks are different* *accept one of the colours in Cola has the highest R_f value*	3	3 / 2.3.2b	E
1(c)	different substances travel at different speeds **or** have different retention times	*accept different attraction to solid* *ignore properties of compounds*	1	1 / 2.3.2c	E

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
1(d)(i)	Is there caffeine in a certain brand of drink?		1	3 / 2.3.2	A
1(d)(ii)	any **two** from: • cannot be done by experiment • based on opinion / *lifestyle choice* • ethical, *social* or economic issue	*accept caffeine has different effects on different people*	2	3 / 2.3.2	E
Total			**11**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID

2 Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	*There is a statement about the bonding and/or structure **or** melting / boiling point of chlorine **or** sodium chloride.*	*There are statements about the bonding and/or structure of chlorine **or** sodium chloride.*	*There are statements about the bonding and/or structure of chlorine **and** sodium chloride.* *There is an explanation of why chlorine is a gas **or** sodium chloride is a solid.*

1 + 2 / 2.1.1f/g 2.2.1a 2.2.2a

E

Examples of chemistry points made in response:

Chlorine:

covalent bonds between atoms

forming simple molecules

no / weak attraction / bonds between molecules

low boiling point

Sodium chloride:

*ionic bonds **or** electrostatic attraction*

strong bonds

in all directions

between oppositely charged ions

forming giant lattice

large amounts of energy needed to break bonds

high melting point

Total			6

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
3(a)	O_2 in correct space		1	2 / 2.4	E
	correct balancing	accept multiples	1		
3(b)(i)		*incorrect reference to energy = max **2***		1 / 2.4.1d	E
		ignore references to equilibrium			
	rate increases		1		
	because particles are closer together	accept because there are more particles (per unit volume)	1		
		allow particles have less space / room to move around			
	so frequency of collisions increases	*accept particles are more likely to collide*	1		
		ignore more collisions			
		ignore more successful collisions			
3(b)(ii)	has a greater surface area		1	3 / 2.4.1f/g	E
	so the reaction is faster	*accept so more frequent collisions*	1		
3(c)	the (minimum) amount of energy (particles must have) to react ***or*** *to start a reaction*	accept the energy needed to break bonds	1	1 / 2.4.1b	E
		ignore references to heat			
3(d)(i)	(potassium is) too / *very* reactive	*ignore potassium is a Group 1 / alkali metal*	1	1 + 2 / 2.6.1b	E
	so dangerous / *violent reaction*	accept hydrogen produced rapidly	1		
3(d)(ii)		accept products in either order		2 / 2.6.2b	E
		ignore names of substances			
		*do **not** accept brackets or charges in the formulae*			
	$ZnSO_4$		1		
	H_2		1		

3(d)(iii)	any **one** from: • increase concentration (of sulfuric acid) • increase temperature **or** heat it • increase surface area of zinc		1	1 / 2.4.1	E

Total			**13**

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)(i)	so ions can move (and carry charge)	accept so current can flow *allow so it can conduct (electricity)* *allow so charged particles can move* *do **not** accept so electrons can move*	1	1 / 2.7.1a/b	E
4(a)(ii)	because zinc ions gain electrons 2 (electrons) zinc is formed	accept because zinc ions are reduced *accept correct half equation for **3** marks* *if no mark gained allow* *positive ions go to negative electrode **or*** *opposites attract **or*** *reduction (of zinc) **or*** *(zinc) gains electrons for **1** mark*	1 1 1	1 + 2 / 2.7.1b/c/e	E
4(a)(iii)	**2** Cl^- ⟶ Cl_2 + **2** e^-	must be completely correct	1	1 / 2.7.1g	E
4(b)(i)	because the magnesium is *a gas*	*allow magnesium goes from solid to gas*	1	2 / 2.6.1a	E
4(b)(ii)	(a reaction which) takes in energy (from the surroundings)	*accept more energy needed to break bonds than released by forming bonds* *accept correct reference to energy level diagram* *allow (a reaction which) takes in heat (from the surroundings)*	1	1 / 2.5.1a/b	E

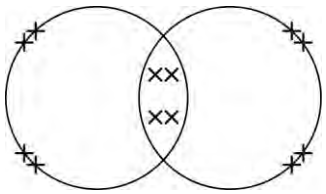
Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(b)(iii)	*(*M_r MgO =) 40	*accept (2* M_r MgO =) 80	1	2 / 2.3.3c	E
	1.2/24 (x40) **or** 0.05 (x40) **or** 40/24 (x1.2) **or** 1.67 (x1.2)	allow ecf from step 1	1		
	2(.0)	allow ecf carried through from step 1 correct answer with or without working gains **3** marks	1		
4(b)(iv)	75(%)		1	2 / 2.3.3e	E
4(b)(v)	any **one** from: • the reaction is reversible • *some lost /escaped/ released (when* separated) • some of the reactant may react in different ways from the expected reaction • *impure reactant(s)*	*accept incomplete reaction* *ignore equilibrium not reached* *ignore measurement and calculation errors*	1	1 / 2.3.3d/f	E
Total			**12**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)	nanotubes can slide (over each other) because no (covalent) bonds between the nanotubes	allow nanotubes can roll (over each other) *accept weak forces between the nanotubes **or** weak intermolecular forces* *allow layers for nanotubes throughout*	1 1	1 / 2.2.3d	E
5(b)	delocalised electrons *so (delocalised) electrons* can move through the graphite	*accept free electrons* *accept so (delocalised) electrons can carry charge through the graphite*	1 1	1 + 2 / 2.2.3c/e	E
Total			**4**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
6(a)(i)	any **two** from: • *100% of (type 1 and type 2) bacteria are killed with a particle size of 7.5 to 8.5 nm* • *as the size increases (beyond 8.5 nm), nanoparticles are less effective at killing (type 1 and type 2) bacteria* • *type 1 shows a linear relationship **or** type 2 is non-linear* • type 1 bacteria more susceptible than type 2 (at all sizes of nanoparticles shown on the graph)	*ignore any conclusion drawn referring to data below 7.5 nm or above 20 nm* *accept nanoparticles in the range of 7.5 to 8.5 nm are most effective at killing (type 1 and type 2) bacteria* *allow type 2 bacteria are harder to kill*	2	3 / 2.2.6a	E
6(a)(ii)	(yes) because you *could confirm the pattern that has been observed* **or** (no) because trend/*conclusion* is already clear	*allow would reduce the effect of anomalous points / random errors* *allow would give better line of best fit* *ignore references to reliability / precision / accuracy / reproducibility / repeatability / validity*	1	3 / 2.2.6a	E

6(b)		reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **3**		1 / 2.1.1c/f	E
	magnesium loses electron(s)		1		
	oxygen gains electron(s)		1		
	<u>two</u> electrons (per atom)		1		
	gives full outer shells (of electrons) ***or*** *eight electrons in highest energy level*	*accept noble gas structure*	1		
	or				
	(electrostatic) attraction between ions **or** forms ionic bonds				

Total			**7**

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7(a)	*weaker bonds* ***or*** *fewer bonds* ***or*** *disruption to lattice*	*allow (other substances) react with the silicon dioxide* *ignore weaker / fewer forces* *do **not** accept reference to intermolecular forces / bonds*	1	2 / 2.2.3a	E
7(b)(i)	Na_2O	*do **not** accept brackets or charges in the formula*	1	2 / 2.1	E
7(b)(ii)	 2 bonding pairs 2 lone pairs on each oxygen	*electrons can be shown as dots, crosses, e or any combination* *accept 4 electrons within the overlap* *accept 4 non-bonding electrons on each oxygen*	 1 1	1 / 2.1	E
7(c)	*lattice / regular pattern / layers / giant structure / close-packed arrangement* (of) positive ions **or** (of) atoms (with) delocalised / free electrons	reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **2**	1 1 1	1 / 2.1.1h/i	E
Total			**7**		