

# GCSE 2004

## *June Series*



## Mark Scheme

### Science: Single Award

### Specification B (Co-ordinated)

*3463/2H*

---

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA  
Tel: 0161 953 1170

or

download from the AQA website: [www.aqa.org.uk](http://www.aqa.org.uk)

Copyright © 2004 AQA and its licensors

#### COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX.

*Dr Michael Cresswell Director General*

## SCIENCE: SINGLE AWARD CO-ORDINATED

### INFORMATION FOR 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 / ; e.g. allow smooth / free movement.)

#### 3. Marking points

##### 3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.

On the script, the QoWC tick should be identified by a ‘q’ written next to it.

##### 3.2 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

### 3.3 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.

### 3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

### 3.5 Marking procedure for calculations

**3.5.1** 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;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

**3.5.2** Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

### 3.6 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.

### 3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

- (a) A candidate who calculates average speed using  $\text{speed} = \text{time}/\text{distance}$  **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.
- (b) A candidate who incorrectly calculates average speed using  $\text{speed} = \text{distance}/\text{time}$  and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

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.

### 3.8 Phonetic spelling

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

### 3.9 Brackets

(.....) is 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.

### 3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

### 3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.



**Single Award  
Higher Tier 3463/2H**

**3463/2H Q1**

question	answers	extra information	mark
(a)(i)	coke	allow coal ignore carbon	1
(ii)	any plausible description of a difference based on diagram or their knowledge e.g. use of water power <b>or</b> smaller scale <b>or</b> use of bellows <b>or</b> use of cold air <b>or</b> slower speed / less efficient	accept converse argument but must be clear	1
(b)(i)	to remove / lose oxygen (owtte)	accept answer in terms of electrons (gain electrons) but <b>not</b> hydrogen	1
(ii)	iron <b>and</b> carbon dioxide	both for <b>1</b> mark accept Fe <b>and</b> CO <sub>2</sub> do <b>not</b> accept Fe and CO <sub>2</sub>	1
(c)	to remove impurities / acidic compounds	accept to form slag (owtte) accept correct chemical description suggesting impurities allow to stop furnace getting blocked	1
(d)	sodium is <u>higher</u> in the reactivity series  than carbon	it = sodium  accept sodium is (very) high in the reactivity series accept sodium is <u>too</u> reactive accept sodium is more reactive than iron / calcium  sodium is reactive = <b>0</b> marks  must be a comparison with carbon for both marks	1  1
(e)(i)	chromium <b>or</b> nickel	accept Cr <b>or</b> Ni	1
(ii)	does not rust / corrode <b>or</b> does not react with water <b>or</b> does not oxidise	ignore references to heat conductivity / conduction or appearance (e.g. tarnish) ignore melting point  any reference to electrical conductivity = <b>0</b> marks	1
total			9

## 3463/2H Q2

question	answers	extra information	mark
(a)	catalyst <b>or</b> speeds up the reaction (owtte)	accept lowers activation energy <b>not</b> just helps reaction to take place ignore increased surface area	1
(b)	C <sub>8</sub> H <sub>18</sub>	allow H <sub>18</sub> C <sub>8</sub> must be upper case do <b>not</b> accept powers	1
(c)	B because it is a gas <b>or</b> because it has small molecules <b>or</b> because <u>they</u> are small	position <b>and</b> reason for mark allow it has a lower / <u>very</u> low boiling point than A ignore references to solubility accept does not condense do <b>not</b> accept light molecules <b>or</b> bubbles into B do <b>not</b> accept <u>it</u> is small	1
(d)	breakdown of a substance (owtte)  by the action of heat (owtte)	do <b>not</b> accept decompose unqualified	1  1
(e)	<b>Quality of written communication</b>  large to small molecules <b>or</b> scientific word that implies smaller, e.g. alkene / ethane / petrol  either advantages of smaller molecules <b>or</b> disadvantages of larger molecules e.g. hydrocarbons with large molecules are limited in their usefulness  large hydrocarbon molecules do not ignite easily / do not flow easily / are not very volatile  more large hydrocarbon molecules are produced than are needed  smaller molecules are useful as fuels  alkenes / products can be used to make polymers	if the written communication makes sense and it is in context then award Q mark  Q ✓ Q X  any name or formula of alkane / alkene smaller than decane  <b>or</b> converse for smaller molecules  <b>or</b> converse for smaller molecules  <b>or</b> converse for smaller molecules	1  1  1
(f)	(fractional) distillation	accept fractionation accept good description do <b>not</b> accept just diagram	1
total			9

## 3463/2H Q3

question	answers	extra information	mark
(a)(i)	argon <b>and</b> potassium <b>or</b> tellurium <b>and</b> iodine <b>or</b> cobalt <b>and</b> nickel	accept correct symbols allow argon <b>and</b> calcium	1
(ii)	it would place them in incorrect <u>groups</u> (owtte)	idea of <u>not</u> being placed with elements which have similar properties <b>or</b> converse argument  accept would not have same number of electrons in outer shell allow it would put them in wrong period if linked to argon and potassium / calcium  do <b>not</b> accept reasons based just on protons do <b>not</b> accept metals and non-metals mixed up	1
(b)	any <b>two</b> from:  • each successive atom has one more electron  • atoms in the same group have the same number of electrons in their <u>outer shells</u> / energy levels  • across a period an energy level / shell is being filled  • in the next period the next energy level / shell is being filled	number of electrons in outer shell = group number  accept period number = shell number	2
total			4



## 3463/2H Q4

question	answers	extra information	mark
(a)	A	accept a <b>or</b> 2, 8, 18, 18, 8, 1	1
(b)	outer shell further from nucleus <b>or</b> outer shell electron less strongly attracted to nucleus <b>or</b> outer shell more shielded	do <b>not</b> accept more shells <b>or</b> larger / bigger atoms alone	1
	so outer shell electron lost <u>more</u> easily (owtte)	accept correct converse linked to lithium 'it' must be linked to caesium outer must be used once at least for both marks	1
total			3

## 3463/2H Q5

question	answers	extra information	mark
(a)(i)	any <b>three</b> from: <ul style="list-style-type: none"> <li>particles / they gain energy</li> <li>particles / they move faster</li> <li>collide more often <b>or</b> more collisions <b>or</b> more chance of collision</li> <li>have more energy when they collide <b>or</b> more energetic collisions <b>or</b> more collisions with activation energy</li> </ul>	accept move more violently ignore vibrate faster <b>or</b> start to move only <b>or</b> more active do <b>not</b> accept move more  accept more successful / fruitful / violent / forceful collisions accept more likely to react	3
(ii)	does not work above 45° C <b>or</b> denatured / damaged / destroyed <b>or</b> only works best at an optimum temperature	some indication of optimum temperature do <b>not</b> accept killed / do not work accept only work over a narrow pH range ignore deactivated <b>or</b> decreases activity <b>or</b> explanations about cost <b>or</b> not removed with product	1
(b)(i)	lower temperature needed (owtte)	read the whole explanation first, may be more than one mark on one statement accept 10° C alone	1
	high yield of product (owtte)		1
	only one product <b>or</b> (virtually) no other products (owtte)	accept no waste products / by products ignore explanations involving cost or specificity of enzymes	1
(ii)	so it functions for a long time <b>or</b> lasts longer <b>or</b> more effective over a longer period	answer must be time related	1
(iii)	enzyme is trapped in / fixed to / bonded to (owtte) / trapped / held to  (inert) solid / resin / (alginate) beads, network / surface / matrix etc.	do <b>not</b> accept deposited <b>or</b> absorbed	1  1
total			10

## 3463/2H Q6

question	answers	extra information	mark
(a)	react with oxygen / oxidise / burn in oxygen / burning / combustion <b>or</b> tungsten to tungsten oxide <b>or</b> makes an oxide	key idea is oxidation ignore breaking ignore fire / flames / exothermic ignore react with air	1
(b)	it is (very) unreactive / not reactive / inert / does not react with tungsten <b>or</b> it is a noble gas <b>or</b> it is in group 0 or 8 or 18	do <b>not</b> accept unreactive / inert metal <b>or</b> argon is not <u>very</u> reactive	1
	full outer shell (of electrons) / 8 electrons in outer shell		1
	does not need to gain / lose / swap / transfer / share electrons <b>or</b> does not need to form bonds	does not bond ionically / covalently	1
total			4

## 3463/2H Q7

question	answers	extra information	mark
(a)	poly(tetrafluoroethene) <b>or</b> polytetrafluoroethene	accept PTFE or Teflon	1
(b)	double bond  all other atoms and bonds correct including F for fluorine  $\begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ -\text{C} = \text{C}- \\   \quad   \\ \text{F} \quad \text{F} \end{array}$	$\begin{array}{c} \text{F} \quad \quad \text{F} \\ \diagdown \quad \diagup \\ \text{C} = \text{C} \\ \diagup \quad \diagdown \\ \text{F} \quad \quad \text{F} \end{array}$ <p>ignore n in front</p> <p><b>or</b></p> $\begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ \text{C} - \text{C} \\   \quad   \\ \text{F} \quad \text{F} \end{array} = 1 \text{ mark}$ $\left( \begin{array}{c} \text{F} \quad \text{F} \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{F} \quad \text{F} \end{array} \right)_n = 1 \text{ mark}$ $\text{CF}_2 = \text{CF}_2 = 1 \text{ mark}$ <p>do <b>not</b> accept structures with more than 2 C atoms</p>	1  1
(c)	any <b>three</b> from: <ul style="list-style-type: none"> <li>• <u>many</u> monomers / (small) molecules / tetrafluoroethene molecules</li> <li>• (monomers, molecules etc.) join / bond / link / combine / attach</li> <li>• to form one molecule <b>or</b> to form a long-chain <b>or</b> to form a large molecule</li> <li>• no other substances are produced / one substance formed (definition of addition)</li> <li>• idea of <u>double bond</u> breaking / opening / opens / bond being used to join to another molecule <b>or</b> the double bond becomes a single bond</li> </ul>	<p>allow <u>many</u> tetrafluoroethenes many particles alone is insufficient do <b>not</b> accept many polymers</p> <p>allow many particles <u>join</u> allow many atoms <u>join</u> do <b>not</b> accept collide / add ignore polymerise do <b>not</b> accept many polymers join</p>	3
total			6