

GCSE 2004

June Series



Mark Scheme

Chemistry Specification B 3421/F

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.

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GCSE CHEMISTRY

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. Boldening

- 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.



**GCSE Chemistry
Foundation Tier 3421/F****3421/F Q1**

question	answers	extra information	mark
	hydrogen / H ₂ / H	accept correct symbol or formula	1
	nickel / Ni		1
	astatine / At / At ₂		1
	bromine / Br / Br ₂		1
	lithium / Li		1
total			5

3421/F Q2

question	answers	extra information	mark
(a)	carbon	accept C	1
(b)	protons		1
total			2

3421/F Q3

question	answers	extra information	mark
(a)	it can provide oxygen which can make other substances burn more fiercely	list principle applies	1
	it can cause reddening or blistering of the skin		1
(b)	gloves		1
	to prevent contact with skin / hands	reason must be linked to clothing	1
	or laboratory coat to prevent contact with skin / clothes etc. or goggles / safety glasses / visor to prevent contact with eyes / splashes etc.	accept any other item of safety clothing e.g. mask for 1 mark only	
(c)(i)	measure volume / mass of gas produced	1 mark is for a sensible way of measuring the amount of product produced and 1 mark is for the idea of timing	1
	in a certain time period <i>e.g.</i> measure volume of gas produced at regular time intervals		1
	or time taken to fill a test tube with the gas or collect a certain volume of gas or measure decrease in mass of flask and contents at regular time intervals or time taken for the mass to decrease by certain amount	(measuring the rate at which bubbles are produced e.g. number of bubbles in 30 seconds gains only 1 mark unless an enclosed system is used)	
(c)(ii)	increases rate (owtte)		1
(c)(iii)	change the concentration or add a catalyst or change the surface area or <u>lower</u> the temperature	accept 'expose to sunlight' (owtte) or change the amount of water / powder / solution used ignore 'stirring'	1
total			8

3421/F Q4

question	answers	extra information	mark
(a)	contains nitrogen and potassium	list principle – must be names	1
(b)	600 g or 0.6 kg	accept 600 with no unit but incorrect unit loses the answer mark if 0.6 is given as the answer then there must be a unit $1000 \times \left(\frac{60}{100} \right)$ for 1 mark	2
(c)	nitric acid		1
	potassium hydroxide		1
	water		1
total			6

3421/F Q5

question	answers	extra information	mark
(a)	bacteria	list principle applies	1
(b)	lactic	list principle applies	1
total			2

3421/F Q6

question	answers	extra information	mark
	limestone / clay - cement		1
	limestone, sand, soda - glass		1
	nitrogen and hydrogen - ammonia		1
total			3

3421/F Q7

question	answers	extra information	mark
(a)	conducts heat	list principle applies after 4 ticks	1
	forms coloured compounds		1
	high melting point		1
	strong		1
(b)	calcium	name only	1
	sodium		1
total			6

3421/F Q8

question	answers	extra information	mark
(a)(i)	high and low	both needed for mark	1
(ii)	reversible		1
(iii)	to prevent ammonium chloride / solid / particles escaping	idea of a filter do not accept 'to prevent gases escaping'	1
(b)	endothermic		1
total			4

3421/F Q9

question	answers	extra information	mark
(a)	hydrogen	accept correct symbols but not H ₂	1
	carbon		1
(b)(i)	water	accept H ₂ O	1
(ii)	limewater / calcium hydroxide	accept Ca(OH) ₂	1
(iii)	milky / cloudy / chalky / white		1
(c)(i)	remains almost the same / increases then decreases slightly from 1000 to 1800		1
	increases / rises after 1800		1
	rapidly (owtte)		1
(ii)	increased burning of hydrocarbon / (fossil) fuels, etc. or increased use of fuels	accept deforestation accept (more) cars / lorries / planes etc. accept power stations do not accept just 'factories'	1
total			9

3421/F Q10

	answers	extra information	mark
(a)	iron	clear indication of chosen answer	1
	oxygen		1
	calcium carbonate		1
	carbon		1
(b)	easily shaped		1
	soft		1
total			6

3421/F Q11

	answers	extra information	mark
(a)	fermentation		1
	water		1
	enzymes		1
	carbon dioxide		1
	air		1
(b)	solvent	accept fuel accept white spirit	1
total			6

3421/F Q12

	answers	extra information	mark
(a)(i)	calcium		1
(ii)	oxygen		1
(iii)	nitrate		1
(b)	Quality of written communication	for correct linking of ideas	1
	answers based on evaporation	e.g. sun evaporates water	1
	answers based on condensation to form water or rain	e.g. clouds rise and cool	1
		starting point of description does not have to start with evaporation	
(c)(i)	nitrate at 34 mg/l on bar chart		1
(ii)	(dissolve) carbon dioxide / CO ₂		1
	pressure		1
total			9

3421/F Q13

	answers	extra information	mark	
(a)	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Calcium chloride</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Lithium sulphate</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Potassium carbonate</div> <div style="border: 1px solid black; padding: 5px;">Sodium nitrate</div> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Add barium chloride solution and dilute hydrochloric acid. A white precipitate formed</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Do the flame test. Yellow flame produced</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Add silver nitrate solution and dilute nitric acid. A white precipitate formed</div> <div style="border: 1px solid black; padding: 5px;">Add hydrochloric acid. Carbon dioxide gas given off.</div>	all three correct = 2 one or two correct = 1	2
(b)	blue precipitate	solid	1 1	
(c)(i)	any one from: <ul style="list-style-type: none"> • mass spectrometry / spectroscopy • atomic (absorption) spectrometry • flame photometry • infra-red spectroscopy • ultra violet spectroscopy • chromatography 	(any valid method)	1	
(ii)	any one from: <ul style="list-style-type: none"> • rapid • sensitive • accurate • small amounts • easily automated • easily computerised 	(any valid answer)	1	
total			6	

3421/F Q14

question	answers	extra information	mark
(a)(i)	argon and potassium or tellurium and iodine or cobalt and nickel	accept correct symbols allow argon and 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 or 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 not accept reasons based just on protons do not accept metals and non-metals mixed up	1
(b)	any two from: • each successive atom has one more electron • atoms in the same group have the same number of electrons in their <u>outer</u> shells / 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

3421/F Q15

question	answers	extra information	mark
(a)	catalyst or speeds up the reaction (owtte)	accept lowers activation energy not just helps reaction to take place ignore increased surface area	1
(b)	C ₈ H ₁₈	allow H ₁₈ C ₈ must be upper case do not accept powers	1
(c)	B because it is a gas or because it has small molecules or because <u>they</u> are small	position and 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 not accept light molecules or bubbles into B do not accept <u>it</u> is small	1
(d)	breakdown of a substance (owtte) by the action of heat (owtte)	do not accept decompose unqualified	1 1
(e)	Quality of written communication large to small molecules or scientific word that implies smaller, e.g. alkene / ethane / petrol either advantages of smaller molecules or 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 or converse for smaller molecules or converse for smaller molecules or converse for smaller molecules	1 1 1
(f)	(fractional) distillation	accept fractionation accept good description do not accept just diagram	1
total			9

3421/F Q16

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 or smaller scale or use of bellows or use of cold air or 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 not hydrogen	1
(ii)	iron and carbon dioxide	both for 1 mark accept Fe and CO ₂ do not accept Fe and CO ₂	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 = 0 marks must be a comparison with carbon for both marks	1 1
(e)(i)	chromium or nickel	accept Cr or Ni	1
(ii)	does not rust / corrode or does not react with water or does not oxidise	ignore references to heat conductivity / conduction or appearance (e.g. tarnish) ignore melting point any reference to electrical conductivity = 0 marks	1
total			9

3421/F Q17

question	answers	extra information	mark
(a)	hydrogen	accept H ₂ do not accept H	1
(b)	litmus paper / Universal Indicator paper / pH paper bleached / turns white or loses its colour	allow any suitable <u>named</u> indicator do not accept bleached cloth / leaves etc. allow second mark unless <u>incorrect</u> indicator given allow starch iodide paper (1) goes black / blue black (1) allow potassium iodide solution (1) goes brown / orange / black precipitate (1)	1 1
(c)	because they have a negative charge or opposite charges attract	accept (because) it is Cl ⁻ accept chlorine, Cl or chlorine ions has a negative charge do not accept Cl ⁻ on its own do not accept Cl ₂ o.e. has negative charge	1
(d)	kill bacteria / germs, etc. or sterilise / disinfect	accept destroys bacteria etc. ignore clean / purify water (owtte) do not accept just gets rid of bacteria	1
(e)	hydroxide (ion)	accept OH ⁻	1
total			6

3421/F Q18

question	answers	extra information	mark
	Quality of written communication	if the written communication makes sense and it is in context then award Q mark Q ✓ QX	1
	any one from: <ul style="list-style-type: none"> • earth movements • movement of tectonic plates • tectonic activity / collision of plates • mountain creation • deep burial / pushed downwards • contact with magma 	any stated activity within the crust accept earthquakes / volcanoes / forces in the crust accept <u>folding</u> do not accept simply describing sedimentation	1
	any one from: <ul style="list-style-type: none"> • (created) high temperatures / heat / very hot • (created) <u>high</u> pressures • (caused) recrystallisation / crystalline rearrangement 	any reference to melting loses this mark do not accept hot unqualified accept idea of more pressure e.g. earthquake creates pressure accept formation of new minerals	1
total			3

3421/F Q19

question	answers	extra information	mark
(a)	100	ignore units $40 + 12 + (3 \times 16)$ for 1 mark	2
(b)	40	(ecf from part (a) can get 2 marks) $\frac{40}{\text{their (a)}} \times 100$ for 1 mark	2
(c)	0.5	(ecf from part (b) can get 2 marks) $1.25 \times \left(\frac{\text{their (b)}}{100} \right)$ or other correct working for 1 mark	2
(d)	gas produced or carbon dioxide / CO ₂ produced		1
total			7

3421/F Q20

question	answers	extra information	mark
(a)	Na_2CO_3	accept $(\text{Na}^+)_2\text{CO}_3^{2-}$ 2 and 3 below halfway do not accept $\text{Na}_2 + \text{CO}_3$	1
(b)(i)	correct number of electrons (18)	accept any combination of dots and crosses	1
	2, 8, 8	2, 8, 8 written on rings = 1 mark	1
(ii)	loses 2 electrons or loses <u>both</u> electrons	loses electrons = 1 mark any answers about gaining electrons = 0 marks	2
(c)(i)	5	accept multiples if all correct	1
(ii)	6	accept multiples if all correct	1
total			7

3421/F Q21

	answers	extra information	mark
(a)(i)	vanadium(V) oxide or V_2O_5 or vanadium pentoxide	accept vanadium oxide or vanadium V oxide do not accept vanadium, vanadium(IV) oxide, platinum etc.	1
(ii)	(concentrated) sulphuric acid or H_2SO_4	do not accept <u>dilute</u> sulphuric acid	1
(iii)	oleum / fuming sulphuric acid or $H_2S_2O_7$ or $H_2SO_4.SO_3$		1
(b)(i)	all points correct smooth curve	$\pm \frac{1}{2}$ square reasonable attempt thickness $\pm \frac{1}{2}$ square	1 1
(ii)	585 range 580 – 590 or correct from ‘their’ graph		1
(c)(i)	$H_2SO_4 = 2 + 32 + 64$ $= 98$	or $32 + 2 + 16 + 1 \frac{1}{2} \times 32$ or $32 + 18 + 48$ $= 98$ allow proof by subtraction answer alone gets 0 marks	1 1
(ii)	answers based on less SO_3 available for stage 3 etc	answers relating to reversible reaction ideas acceptable	1
(d)	sodium hydroxide gives hydroxide ions / OH^- (Arrhenius) answers based on the link between hydroxide <u>ions</u> / OH^- and hydrogen ions / H^+ (from the acid) (Arrhenius) or sodium hydroxide / OH^- reacts with hydrogen ions / H^+ answers based on the idea that hydrogen ions / H^+ are protons (Brønsted & Lowry)	answers based on the <u>link</u> between hydroxide <u>ions</u> / OH^- and protons (from the acid) (Brønsted & Lowry) or sodium hydroxide / OH^- accepts protons answers based on the idea that protons are hydrogen ions (Arrhenius)	1 1 1
total			12