

# **Chemistry A**

General Certificate of Secondary Education

Unit **A171/01**: Modules C1, C2, C3 (Foundation Tier)

## **Mark Scheme for January 2013**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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**Annotations**

Used in the detailed Mark Scheme:

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
<b>not/reject</b>	answers which are not worthy of credit
<b>ignore</b>	statements which are irrelevant - applies to neutral answers
<b>allow/accept</b>	answers that can be accepted
(words)	words which are not essential to gain credit
<u>words</u>	underlined words must be present in answer to score a mark
ecf	error carried forward
AW/owtte	credit alternative wording / or words to that effect
ORA	or reverse argument

Available in scoris to annotate scripts:

	indicate uncertainty or ambiguity
	benefit of doubt
	contradiction
	incorrect response
	error carried forward
	draw attention to particular part of candidate's response
	no benefit of doubt
	reject
	correct response

<input type="text" value="L1"/> , <input type="text" value="L2"/> , <input type="text" value="L3"/>	indicate level awarded for a question marked by level of response
<input type="text" value="^"/>	information omitted

**Subject-specific Marking Instructions**

- a. Accept any clear, unambiguous response (including mis-spellings of scientific terms if they are *phonetically* correct, but always check the guidance column for exclusions).
- b. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

*e.g. for a one-mark question where ticks in the third and fourth boxes are required for the mark:*

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth 1 mark.*

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth 0 marks.*

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

*This would be worth 1 mark.*

- c. The list principle:  
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

d. Marking method for tick-box questions:

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses and other markings. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses. Credit should be given according to the instructions given in the guidance column for the question. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

e.g. if a question requires candidates to identify cities in England:

Edinburgh	<input type="checkbox"/>
Manchester	<input type="checkbox"/>
Paris	<input type="checkbox"/>
Southampton	<input type="checkbox"/>

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
<b>Score:</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>NR</b>

- e. For answers marked by levels of response:
- i. **Read through the whole answer from start to finish**
  - ii. **Decide the level that best fits** the answer – match the quality of the answer to the closest level descriptor
  - iii. **To determine the mark within the level**, consider the following:

<b>Descriptor</b>	<b>Award mark</b>
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

- iv. Use the **L1, L2, L3** annotations in Scoris to show your decision; do not use ticks.

Quality of Written Communication skills assessed in 6-mark extended writing questions include:

- appropriate use of correct scientific terms
- spelling, punctuation and grammar
- developing a structured, persuasive argument
- selecting and using evidence to support an argument
- considering different sides of a debate in a balanced way
- logical sequencing.

Question			Answer	Marks	Guidance
1	(a)	(i)	190	1	
		(ii)	7	1	
	(b)	(i)	yes because (no mark) particulate concentration fell after charge was introduced (1) particulate concentration was below the limit ( $150\mu\text{g}/\text{m}^3$ ) after charge was introduced (1) charge reduced air pollution in the town centre (1)	3	<b>allow</b> reverse argument e.g. no because (no mark) particulates still in town centre after charge introduced (1) particulates not high on all days before charge (1) charge did not stop air pollution in town centre (1)
		(ii)	<i>any two from:</i> fewer cars entering the town (1) people do not want to pay the charge (1) people use different method of transportation e.g. car share / use public transport / walk / cycle / do not go into town (1)	2	<b>allow</b> answers which refer to the charge being expensive <b>ignore</b> comments about drivers rather than cars
	(c)		water carbon dioxide oxygen	2	all three correct for 2 marks two correct for 1 mark
<b>Total</b>				<b>9</b>	

Question		Answer	Marks	Guidance	
2	(a)	<p><b>Level 3 (5–6 marks)</b> Answer that makes clear the relationship between NO<sub>2</sub> and number of vehicles and explains this in terms of the reactions in the car engine, and in air. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Answer that makes clear the relationship between NO<sub>2</sub> and vehicles, and tries to explain this in terms of reactions in a car engine. Quality of written communication partially impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Answer that makes clear the relationship between NO<sub>2</sub> and vehicles. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Indicative scientific points may include:</b></p> <ul style="list-style-type: none"> <li>• as number of vehicles increases nitrogen dioxide (concentration) increases</li> <li>• this relationship is proportional</li> <li>• there is a (positive) correlation between number of vehicles and nitrogen dioxide concentration</li> <li>• scatter on graph results from different vehicles / wind direction etc</li> <li>• vehicle engines are the cause of nitrogen dioxide pollution</li> <li>• nitrogen and oxygen react together in a car engine</li> <li>• nitrogen and oxygen are from the air</li> <li>• the reaction takes place at high temperature</li> <li>• NO from the exhaust reacts with O<sub>2</sub> in air to make NO<sub>2</sub></li> </ul> <p><b>ignore</b> references to catalytic converters</p> <p><b>Use the L1, L2, L3 annotations in Scoris: do not use ticks</b></p>	
	(b)	(i)	there is always some variation in measurements (1) can work out a mean / average as a best estimate of the true value(1)	2	<b>allow</b> can identify outliers / taking only one sample could be faulty (1)
		(ii)	120 to 124	1	<b>allow</b> 124 to 120
	(c)	<p><i>any three from:</i> different vehicles (1) different weather conditions (1) different day of week / time of the day (1) hill on motorway (1)</p>	3	<b>ignore</b> references to number of cars	
<b>Total</b>			<b>12</b>		



Question		Answer	Marks	Guidance
3	(a)	as fuels (1) as lubricants (1)	2	<b>ignore</b> named examples of fractions e.g. diesel, bitumen <b>ignore</b> references to monomers / polymers / plastics / named polymers / making pharmaceuticals etc <b>allow</b> making roads
	(b)	longer molecules have more / stronger forces between them (1) more energy needed to separate longer molecules (1)	2	<b>allow</b> longer chain have higher boiling points for 1 mark
	(c)	<div style="text-align: right;"> <input type="checkbox"/>  <input type="checkbox"/>  <input checked="" type="checkbox"/>  <input type="checkbox"/>  <input checked="" type="checkbox"/> </div> <p>Many small monomer molecules join together.</p> <p>Large molecules with long chains of atoms are made.</p>	2	
	(d)	named sensible article eg tennis racquet (no mark) old material consistent with article eg wood (1) new material consistent with article eg carbon fibre (1)	2	<b>allow</b> 'plastic' for new material
<b>Total</b>			<b>8</b>	

Question		Answer	Marks	Guidance	
4	(a)	(i)	10	1	
		(ii)	$500 \times 10 / 100$ (1) $= 50$ (1)	2	<b>allow</b> 2 marks for correct answer without working <b>allow</b> ecf from (a) (i)
	(b)		<p>Plasticizer has mixed unevenly in the polymer.</p> <p style="text-align: right;"><input type="checkbox"/></p> <p style="text-align: right;"><input checked="" type="checkbox"/></p> <p style="text-align: right;"><input type="checkbox"/></p> <p style="text-align: right;"><input type="checkbox"/></p> <p>Different batches of the polymer have different chain lengths.</p> <p style="text-align: right;"><input checked="" type="checkbox"/></p> <p style="text-align: right;"><input type="checkbox"/></p>	2	

Question		Answer	Marks	Guidance
	(c)	<p><b>Level 3 (5–6 marks)</b> Answer identifies most suitable plastic based on discussion of flexibility and range of data from the table. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Answer may identify most suitable plastic based on some discussion of flexibility and range of data from the table. Quality of written communication partially impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Answer may identify most suitable plastic. Discussion is limited to flexibility or range of data from the table. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p><b>This question is targeted at grades up to C</b></p> <p><b>Indicative scientific points may include:</b></p> <ul style="list-style-type: none"> <li>• plastic needs to be not too rigid but not too flexible</li> <li>• plastic needs to have small range of flexibility</li> <li>• plastic A is too flexible</li> <li>• plastic C has too large a range</li> <li>• plastic B is best choice</li> </ul> <p><b>Use the L1, L2, L3 annotations in Scoris: do not use ticks</b></p>
		<b>Total</b>	<b>11</b>	

Question		Answer	Marks	Guidance
5	(a)	DBAC	2	4 correct scores 2 marks 3 or 2 correct scores 1 mark
	(b) (i)	paper	1	
	(ii)	polythene	1	
	(iii)	<i>any two from:</i> polythene uses least energy (1) polythene uses least fossil fuel (1) polythene produces least solid waste (1) polythene gives least greenhouse gases (1) polythene uses least water (1)	2	<b>allow</b> AW for less e.g. not as much / lower / low instead of least  all answers must refer to categories in the table
	(iv)	Polythene bags may cause litter. <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Polythene takes a long time to decompose. <input checked="" type="checkbox"/>	2	
	(v)	some plasticizers are toxic (1)  they can leach out of plastic (1)	2	<b>allow</b> poisonous / harmful <b>ignore</b> causes health problems <b>allow</b> 'leak' as AW
<b>Total</b>			<b>10</b>	

Question		Answer	Marks	Guidance
6	(a)	<p><b>Level 3 (5–6 marks)</b> Answer gives full details of both advantage and disadvantage. Quality of written communication does not impede communication of the science at this level.</p> <p><b>Level 2 (3–4 marks)</b> Answer gives some details of both advantage and disadvantage, or one in full detail. Quality of written communication partially impedes communication of the science at this level.</p> <p><b>Level 1 (1–2 marks)</b> Answer relates only to advantage or disadvantage in limited detail, not both. Quality of written communication impedes communication of the science at this level.</p> <p><b>Level 0 (0 marks)</b> Insufficient or irrelevant science. Answer not worthy of credit.</p>	6	<p>This question is targeted at grades up to E</p> <p><b>Indicative scientific points may include:</b></p> <p><b>Advantages;</b></p> <ul style="list-style-type: none"> <li>• chlorine kills bacteria</li> <li>• bacteria can cause disease</li> <li>• disease can be spread in water supply</li> <li>• example of water-borne disease eg cholera</li> </ul> <p><b>Disadvantages;</b></p> <ul style="list-style-type: none"> <li>• chlorine reacts with organic materials in water</li> <li>• product is toxic / carcinogen.</li> <li>• products of this reaction can affect health</li> </ul> <p><b>Ignore</b> taste / colour / smell of water</p> <p><b>Use the L1, L2, L3 annotations in Scoris: do not use ticks</b></p>
	(b)	<p><b>mercury cell:</b> (mercury) is toxic (1) (mercury) is released into water supplies (1)</p> <p><b>membrane cell:</b> chlorine leaks into sodium hydroxide (1) and needs to be separated (1)</p> <p><b>OR</b> sodium hydroxide is dilute (1) sodium hydroxide needs to be concentrated (1)</p>	4	
<b>Total</b>			<b>10</b>	

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