

**COMPONENT 2 – Concepts in Chemistry****HIGHER TIER****MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

### Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

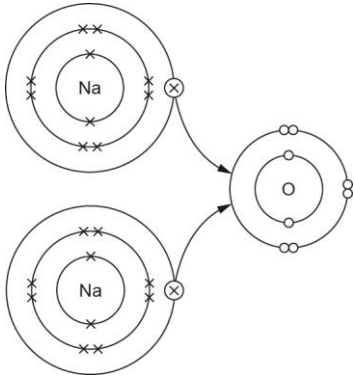
### Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

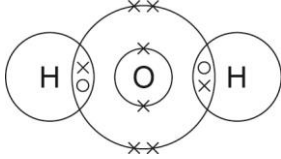
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

## GCSE COMBINED SCIENCE Sample Assessment Materials 142

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		3.0 identified as anomalous result			1	1		1
		(ii)		Any of following points for (1) Not enough magnesium added Too much solution used Reading taken too quickly after addition / without stirring			1	1		1
	(b)	(i)		Both scales correct (1) All 5 points plotted correctly (1) Smooth curve drawn (1)		3		3	3	
		(ii)		0.8 g <b>because</b> no additional temperature increase when a greater mass added			1	1		1
	(c)	(i)		Iron is more reactive than copper (1)  Displacement reaction occurs / iron displaces the copper (1)	1					
		(ii)		Reactants – copper(II) sulfate <b>and</b> iron (1)  Products – iron(II) sulfate <b>and</b> copper (1) Accept iron sulfate			2	2		
	(d)			$\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$ (2)  If equation not correct award (1) for $\text{AgNO}_3$ and Ag included on appropriate sides			2	2		
				<b>Question 1 total</b>	<b>1</b>	<b>8</b>	<b>3</b>	<b>12</b>	<b>3</b>	<b>5</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	 <p>Movement of electrons as shown</p>		1		1		
		(ii)	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 10px;"><math>[2:8]^+</math></div> <p>Electron configuration of sodium ions with + charge (1) Accept if this is shown only once</p> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 10px;"><math>[2:8]^{2-}</math></div> <p>Electron configuration of oxide ion with 2– charge (1)</p>						
		(iii)	<p>Sodium and oxide ions have opposite charges (1)</p> <p>Strong attraction holds them together (1)</p>	2			2		
		(iv)	B		1		1		

## GCSE COMBINED SCIENCE Sample Assessment Materials 144

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)		 <p>Correct diagram as shown (2)</p> <p>Award (1) if hydrogen and oxygen atom included and correct representation of one bonding pair between them [hydrogen's only electrons]</p>		2		2		
	(c)		<p>Strong bonds between all atoms in diamond (1)</p> <p>Weak forces between hydrogen molecules (1)</p> <p>Requires lots of heat/energy to break the bonds in diamond but only small amount to overcome forces in hydrogen (1)</p>	3			3		
			<b>Question 2 total</b>	<b>5</b>	<b>6</b>	<b>0</b>	<b>11</b>	<b>0</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
<b>3</b>	(a)			9		1		1		
	(b)			Group 6 <b>and</b> Period 2 (1)  Group linked to number of electrons in outer shell (1)  Period linked to number of (occupied) shells (1)	1	1		3		
	(c)			Positive ion – <b>G</b> (1) Negative ion – <b>B</b> (1)		2		2		
	(d)			<b>D</b>		1		1		
	(e)			Atoms having the same atomic number but different mass number/number of neutrons (1)  Shown by <b>D</b> and <b>E</b> from the table – one has 10 neutrons and the other has 12 (1)	2			2		
				<b>Question 3 total</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>0</b>

## GCSE COMBINED SCIENCE Sample Assessment Materials 146

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			C – copper(II) carbonate (1) B – copper(II) nitrate (1) D – carbon dioxide (1)			3	3		
	(b)			A – hydrogen (1) Test with lighted splint – gives 'pop' (1)	1	1		2		1
	(c)			$\text{HNO}_3 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$ 1 mark RHS 1 mark LHS		2		2		
				<b>Question 4 total</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>1</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	Reduction involves the loss of oxygen (1) Reaction 2 – carbon dioxide is reduced to carbon monoxide (1) Reaction 3 - iron(III) oxide is reduced to iron (1)	3			3		
		(ii)	Reaction between acid and base (1) In reaction 5, CaO (base) reacts with SiO <sub>2</sub> (acid) (1)	2			2		
	(b)	(i)	Aluminium ions are positive therefore attracted to cathode / negative electrode (1)  Aluminium ions gain 3 electrons to form aluminium atoms (1)  $\text{Al}^{3+} + 3\text{e}^{-} \rightarrow \text{Al}$ (1)	1  1		1	3		
		(ii)	$\left(\frac{45}{100}\right) \times 1.02 \times 10^6$ (1)  $M_r \text{Al}_2\text{O}_3 = 102$ (1)  Mass ratio 204 : 108 (1)  Answer = $2.43 \times 10^5$ (1)  Accept calculation by alternative method using mole ratios	1		1  1  1	4	4	



## GCSE COMBINED SCIENCE Sample Assessment Materials 148

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	<p>Any two correct properties of aluminium – other than good electrical conductivity (1) Use linked to <b>both</b> properties (1)</p> <p>For example, low density and corrosion resistant therefore used to build aircraft (2)</p>	2			2		
	(c)		<p>Sodium chloride (1)</p> <p>Soluble therefore can be used in aqueous condition...no need for melting (1) Both needed for the mark</p>			2	2		2
			<b>Question 5 total</b>	<b>10</b>	<b>4</b>	<b>2</b>	<b>16</b>	<b>4</b>	<b>2</b>

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	Higher the temperature, the faster the rate (1) Particles given more energy, therefore more faster (1) Greater chance of collision (1)	1 1	1		3		
		(ii)	Rate = $\frac{1}{32 \times 10^{-4}}$ (1)  312.5 (1)		2		2	2	
		(iii)	10 °C change in temp doubles rate (1)  Should demonstrate this using at least three temperature that show 10 °C show doubling (1) e.g. Temp (°C)    rate (s <sup>-1</sup> ) 20            4 × ... 30            8 × ... 40            16 ×			2	2		
	(b)		The catalyst increases the rate of reaction (1) Otherwise higher temperature would be required which has higher cost (1)	2			2		
			<b>Question 6 total</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>9</b>	<b>2</b>	<b>0</b>

## GCSE COMBINED SCIENCE Sample Assessment Materials 150

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)	By fractional distillation (1) Which separates fractions by differences in boiling point (1)	2			2		
		(ii)	One of $C_{17}H_{36}$ / $C_{18}H_{38}$ / $C_{19}H_{40}$ / $C_{20}H_{42}$		1		1		
		(iii)	Process of cracking used (1) which involves breaking longer chain molecules into smaller molecules (1) Since demand for $C_{17}$ - $C_{20}$ > supply then cracking produces smaller molecules which are in greater demand (1)	1	1		3		
	(b)		Energy required (in breaking bonds) = 2648 (1)  Energy released (in forming bonds) = 3266 (1)  -818 / 818 (1)  Exothermic reaction <b>because</b> more energy is given out (in forming bonds) than is required (in breaking bonds) (1)		1  1  1		4	3	
	(c)	(i)	C $\frac{0.72}{12}$ H $\frac{0.16}{1}$ (1)  C : H ratio is 0.06 : 0.16 (1)  Simplest ratio is 3 : 8 therefore formula is $C_3H_8$ (1)				3	3	2
		(ii)	$M_r C_3H_8 = 44$ (1)  Number of moles = 3 (1)  Number of molecules = $3 \times 6 \times 10^{23} = 1.8 \times 10^{24}$ (1)	1  1	1		3		3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		Marks awarded for discussion: Cotton <ul style="list-style-type: none"> <li>• requires fertilisers to produce it</li> <li>• gives emissions of SO<sub>2</sub> – polyesters do not</li> </ul> Both required for (1) Negative environmental impact of one of these e.g. SO <sub>2</sub> linked to acid rain (1)  However less energy and fuel is used with cotton (1) Environmental benefit of this observation e.g. less use of crude oil reducing pollution risk (1)			4	4		
			<b>Question 7 total</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>20</b>	<b>8</b>	<b>0</b>

Question		Marking details	Marks Available					
			AO1	AO2	AO3	Total	Maths	Prac
8		<p><b>Indicative content:</b>  <b>AO2 allocation</b> - Suitable acid = hydrochloric acid, alkali = potassium hydroxide            Word equation / symbol equation  <b>AO1 allocation</b> - Acid /alkali interchangeable</p> <ul style="list-style-type: none"> <li>- measured amount of alkali in conical flask</li> <li>- add indicator <i>e.g. phenolphthalein</i></li> <li>- add acid..... drop-wise near end point/ colour change..... to alkali</li> <li>- record volume of acid added</li> <li>- repeat without indicator .....adding recorded volume of acid ( or remove indicator with charcoal)</li> <li>- boil off some of the water</li> <li>- leave solution to evaporate</li> <li>- dry crystals obtained</li> </ul> <p><i>Accept sequenced labelled diagrams</i></p> <p><b>5-6 marks:</b>            Selects appropriate acid base.            Detailed description of titration technique with indicator.            Understands need to repeat titration without indicator.            Describes how to reduce volume water (not to dryness) and then to obtain crystals.            Balanced symbol equation.            Described technique would allow candidate to obtain crystals.  <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p>	5	1		6		6

			<p><b>3-4 marks:</b>          Selects appropriate acid &amp; base.          Description of titration technique with indicator.          Understands need to repeat titration without indicator.          Describes how to obtain crystals.          Attempt at balanced symbol equation.          Described technique would be suitable with some more detail.  <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p> <p><b>1-2 marks:</b>          Suitable acid and base identified.          Basic description of a technique which involves neutralisation.          May not describe all stages (e.g. need to repeat without indicator may be missing).          Word equation.  <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p><b>0 marks:</b> No attempt made or no response worthy of credit.</p>						
			<b>Question 8 total</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>6</b>

**COMPONENT 2 – Concepts in Chemistry****HIGHER TIER****SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

<b>Question</b>	<b>AO1</b>	<b>AO2</b>	<b>AO3</b>	<b>TOTAL MARK</b>	<b>MATHS</b>	<b>PRAC</b>
<b>1</b>	<b>1</b>	<b>8</b>	<b>3</b>	<b>12</b>	<b>3</b>	<b>5</b>
<b>2</b>	<b>5</b>	<b>6</b>	<b>0</b>	<b>11</b>	<b>0</b>	<b>0</b>
<b>3</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>0</b>
<b>4</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>1</b>
<b>5</b>	<b>10</b>	<b>4</b>	<b>2</b>	<b>16</b>	<b>4</b>	<b>2</b>
<b>6</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>9</b>	<b>2</b>	<b>0</b>
<b>7</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>20</b>	<b>8</b>	<b>0</b>
<b>8</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>6</b>
<b>TOTAL</b>	<b>36</b>	<b>36</b>	<b>18</b>	<b>90</b>	<b>17</b>	<b>14</b>