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# **GCSE MARKING SCHEME**

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**SUMMER 2019**

**GCSE  
CHEMISTRY – COMPONENT 2**

**C410U20-1  
C410UB0-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

## GCSE CHEMISTRY COMPONENT 2: Applications in Chemistry

### 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.

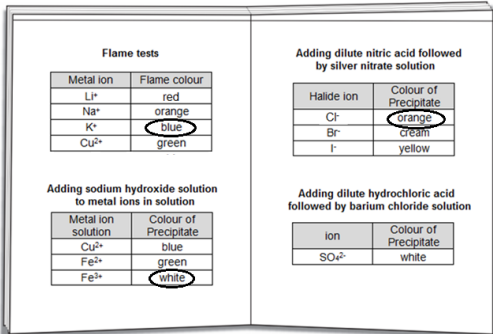
cao = correct answer only  
ecf = error carried forward  
bod = benefit of doubt

Foundation Tier - Section A

Question			Marking details	Marks available																									
				AO1	AO2	AO3	Total	Maths	Prac																				
1	(a)		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Tube 1</th> <th>Tube 2</th> <th>Tube 3</th> <th>Tube 4</th> <th>Tube 5</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">✓</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="text-align: center;">✓</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="text-align: center;">✗</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✗</td> <td style="text-align: center;">✓</td> </tr> </tbody> </table> <p>award (1) for each tube - all conditions must be correct empty box ≡ cross</p>	Tube 1	Tube 2	Tube 3	Tube 4	Tube 5	✓	✗	✓	✗	✓	✓	✗	✗	✓	✓	✗	✗	✗	✗	✓		2		2		2
Tube 1	Tube 2	Tube 3	Tube 4	Tube 5																									
✓	✗	✓	✗	✓																									
✓	✗	✗	✓	✓																									
✗	✗	✗	✗	✓																									
	(b)		to prevent water / moisture coming into the tube	1			1		1																				
	(c)		tube 2			1	1		1																				
	(d)		<p>award (1) each for any <b>two</b> variables and (1) each for how they were controlled</p> <p>nail            same <b>size</b> / same <b>material</b> / same <b>surface area</b></p> <p>time            same <b>length</b> of time / <b>1 week</b> for all nails</p> <p>temperature   room temperature for each</p> <p>credit both marks for any variable if answer is given in either column</p>		4		4		4																				

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			air and water are <b>both</b> needed for rusting to take place / water or air on their <b>own</b> doesn't cause rusting (1)  salt increases the rate of rusting (1)  neutral answers water on its own doesn't cause rusting air on its own doesn't cause rusting  air $\equiv$ oxygen			2	2		2
				<b>Question 1 total</b>	<b>1</b>	<b>6</b>	<b>3</b>	<b>10</b>	<b>0</b>	<b>10</b>

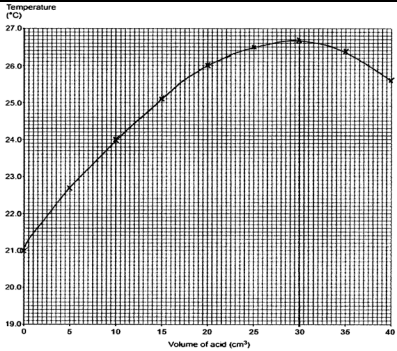
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		brand A green		1		1		1
		(ii)		red			1	1		1
		(iii)		6			1	1		1
	(b)			5 (2) if incorrect award (1) for 8 as distance moved by solvent front	1	1		2	1	2
				<b>Question 2 total</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>5</b>

Question		Marking details		Marks available					
				A01	A02	A03	Total	Maths	Prac
3	(a)		 <p>award (1) for each incorrect observation identified</p> <p>accept answers where the ion is circled rather than the observation</p>	3			3		3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	flame test (1) brick-red (colour) (1)		2		2		2
		(ii)	carbon dioxide / CO <sub>2</sub> (1) (bubble into) <b>limewater</b> (and it) goes <b>milky</b> (1) neutral answer – lit splint is extinguished	2			2		2
		(iii)	step 2 – <b>filter</b> to <b>collect the calcium carbonate</b> (1) step 3 – <b>dry / heat</b> to <b>remove the water</b> (1) process and reason <b>both</b> needed award (1) for <b>both</b> processes but no explanations		2		2		2
			<b>Question 3 total</b>	<b>5</b>	<b>4</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>9</b>



Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	I	burette	1			1		1
			II	thermometer	1			1		1
		(ii)		award (1) for either of following <ul style="list-style-type: none"> <li>to quickly find out the approximate volume (of acid) needed</li> <li>to get a rough result in a short time</li> </ul>	1			1		1
		(iii)		yes - because the results are all close together / there is little variation between the results  accept there are no anomalous results			1	1		1
		(iv)		19.90 / 19.9		1		1	1	1
		(v)		5.0 (1) accept 4.975 / 4.98  volume is four times less because its concentration is four times more / it contains four times as much acid in the same volume (1)  award (1) for any lower volume <b>and</b> an explanation that the volume is lower because it has a higher concentration / more acid in the same volume			2	2	2	2

Question			Marking details	Marks available					
				A01	A02	A03	Total	Maths	Prac
	(b)	(i)	 <p>award (2) for all points plotted correctly      tolerance <math>\pm\frac{1}{2}</math> square  award (1) for 5-8 points plotted correctly  award (1) for smooth curve through points</p>		3		3	3	3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)	I	5.7 accept correct answer based on variation in graph		1		1	1	1
			II	30 accept correct answer based on variation in graph		1		1	1	1
		(iii)		<b>cup/polystyrene</b> acts as an <b>insulator/insulates</b> (1) <b>both</b> needed  award (1) for any sensible suggestion e.g. <ul style="list-style-type: none"> <li>• put a lid on the cup</li> <li>• wrap the cup in foil</li> </ul>	1	1		2	1	2
		(iv)		award (1) for any of following or sensible suggestion <ul style="list-style-type: none"> <li>• put cup in a beaker</li> <li>• clamp the cup</li> <li>• clamp the thermometer</li> </ul> neutral answer – hold the cup	1			1	1	1
				<b>Question 4 total</b>	<b>5</b>	<b>7</b>	<b>3</b>	<b>15</b>	<b>8</b>	<b>15</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5				<p><b>Indicative content</b></p> <ul style="list-style-type: none"> <li>place each metal separately into water – small quantity of metal / large container or large volume of water</li> <li>lithium – float / fizz / move</li> <li>sodium – float / fizz / move / melt / ball</li> <li>potassium – float / fizz / move / melt / ball / burn / lilac flame</li> <li>more reactive down the group</li> <li>safety precautions – eye protection / goggles / safety screen / tweezers</li> </ul>						
				<p><b>5-6 marks</b> Comprehensive description of the observations of the reactions of all three metals; correct trend in reactivity; two sensible safety precautions <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</i></p> <p><b>3-4 marks</b> Description referring to all three metals; correct trend in reactivity or two sensible safety precautions <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</i></p> <p><b>1-2 marks</b> Basic description of one or two observations; reference to one safety precaution <i>There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p><b>0 marks</b> <i>No attempt made or no response worthy of credit.</i></p>	6			6		4
				<b>Question 5 total</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>4</b>

**Foundation Tier - Section B**  
**Higher Tier - Section A**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6/1	(a)		award (1) each for any <b>three</b> of following <ul style="list-style-type: none"> <li>• to conserve resources of iron or iron ore (allow steel) / iron is a limited resource or non-renewable</li> <li>• to avoid the need for quarrying / mining</li> <li>• to conserve energy resources or fossil fuels</li> <li>• to limit the amount of carbon dioxide produced / reduce global warming</li> <li>• to reduce the amount of landfill</li> <li>• it is cheaper than producing new steel</li> </ul>	3			3		
	(b)	(i)	award (1) for any of following <ul style="list-style-type: none"> <li>• may be corroded</li> <li>• may be damaged by accidents</li> <li>• not suitable for different types / models of cars</li> </ul> neutral answer – too old			1	1		
		(ii)	$\frac{1.9}{6} = 0.317$ tonnes <b>must</b> be to 3 sig figs		1		1	1	
	(c)	(i)	$\frac{25}{420} \times 100 = 5.95\%$ accept 6%		1		1	1	
		(ii)	$25 \times 138 = \text{£}3450$ million  accept $\text{£}3.45$ billion		1		1	1	

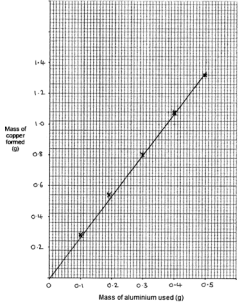
Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	alloy	1			1		
		(ii)	award (1) for any of following <ul style="list-style-type: none"> <li>increases hardness</li> <li>increases durability</li> <li>increases melting point</li> </ul> neutral answer - increases resistance to corrosion	1			1		
		(iii)	award (1) for any of following <ul style="list-style-type: none"> <li>does not corrode / rust (so can be regularly washed)</li> <li>it retains its lustre</li> <li>it is shiny</li> </ul>	1			1		
	(e)		award (2) for either of following <ul style="list-style-type: none"> <li>production increases by larger amounts each year</li> <li>production increases exponentially</li> <li>production increases by 5% each year / 10% every two years</li> <li>production nearly doubles every 10 years</li> <li>rate of increase of production increases over time</li> </ul> award (1) for either of following <ul style="list-style-type: none"> <li>production increases over time</li> <li>the graph's slope increases with time</li> <li>the graph is an exponential curve</li> </ul>			2	2		

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
	(f)			1970 = 5 Mt (1) 35% of 12 Mt is 4.2 Mt (1) this is not close to the value read from the graph so the method does <b>not</b> produce a good estimate (1) ECF possible for sensible answer linked to calculation		1				1	
				<b>Question 6/1 total</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>15</b>	<b>4</b>	<b>0</b>	

### Higher Tier - Section B

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)	19.05g / 19.1 / 19g (2)  if incorrect award (1) for either of following  (2 × 27) Al ⇒ (3 × 63.5) Cu 54g Al ⇒ 190.5g Cu  or  0.2 mol Al ⇒ 0.3 mol Cu		2		2	2	
		(ii)	water remains / not dried for long enough / not dried properly (1)  dry with filter paper / dry for longer time / heat / dry to constant mass (1)			2	2		2
		(iii)	award (1) for either of following <ul style="list-style-type: none"> <li>• swirl solution around to make sure it washes all copper into the filter paper</li> <li>• wash/rinse copper out of the flask with more water</li> </ul>			1	1		1



Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(b)	(i)		 <p>suitable scale (more that 50% of grid used on both axes) (1)</p> <p>all points plotted correctly (1)      tolerance <math>\pm\frac{1}{2}</math> square</p> <p>straight line of best fit (1)</p> <p>accept line not drawn to origin</p>		3		3	3	3
	(ii)		<p>the mass of copper (formed) is directly proportional to the mass of aluminium (added) (2)</p> <p>as the mass of aluminium (added) increases so does the mass of copper (formed) (1)</p>		2		2		2
	(iii)		<p>line of best fit extended on graph to enable the value for 3.0 g to be read off (1) (some working <b>must</b> be shown on graph)</p> <p>value in the range 10.3-10.5 read from graph (1)</p>		2		2	2	2
(c)			<p>correct that repeating is a good idea because it allows results to be checked / identifies anomalies (1)</p> <p>incorrect that it improves accuracy (1)</p>	2			2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			method is reproducible as most of the values are close together (1)  group 4 have recorded an anomalous result / group 4 result does not follow the pattern (1)			2	2		2
				<b>Question 2 total</b>	<b>2</b>	<b>9</b>	<b>5</b>	<b>16</b>	<b>7</b>	<b>14</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	<p>sodium carbonate and ammonium carbonate (1) <b>both</b> needed</p> <p><u>carbonates</u> give <u>carbon dioxide</u> gas (when hydrochloric acid is added) (1)</p>	2			2		2
		(ii)	<p>sodium chloride, lithium iodide and ammonium bromide (1) <b>all</b> needed</p> <p>halides / halide ions produce a precipitate (when silver nitrate solution is added) (1)</p> <p>accept chlorides, bromides and iodides or Group 7 ions form (different coloured) solids when silver nitrate is added</p> <p>ignore any reference to precipitate colours</p>		2		2		2
		(iii)	<p>ammonia / NH<sub>3</sub> (1) do <b>not</b> accept ammonium</p> <p>(damp) <u>red litmus</u> turns <u>blue</u> (1)</p>	2			2		2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	add sodium hydroxide (solution to both) (1) iron(II) (sulfate gives a) green precipitate (1) iron(III) (sulfate gives a) brown precipitate (1)  if observations incomplete award (1) for either of following <ul style="list-style-type: none"> <li>iron(II) and iron(III) give different colour precipitates</li> <li>iron(II) turns green and iron(III) turns brown</li> </ul> ignore any attempt to name the precipitates	3			3		3
		(ii)	(add) barium chloride solution (1) (produces a) white precipitate (1)	2			2		2
			<b>Question 3 total</b>	<b>9</b>	<b>2</b>	<b>0</b>	<b>11</b>	<b>0</b>	<b>11</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	I	to <b>correctly / only</b> measure the temperature of the <b>vapour</b> / fraction being collected (1)  accept liquid in the flask has a different temperature to the vapour / fraction being collected		1		1		1
			II	to ensure the vapours / fractions (with low boiling points) <b>condense</b> in the tube (1)  reference to the fractions having low boiling points is neutral			1	1		
		(ii)		award (1) for either of following <ul style="list-style-type: none"> <li>the higher the boiling point (range), the darker the colour</li> <li>the higher the boiling point (range), the more viscous / less runny the fraction</li> </ul> answer must refer to the boiling point (range); reference to chain length is neutral			1	1		
	(b)			tests can be given in either order  award (1) for every compound identified  bromine water ⇒ pentene  (acidified) potassium dichromate ⇒ pentanol  no positive result for either test ⇒ pentane  accept reference to alkane, alkene and alcohol instead of compound names	3			3		3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) for any of following <ul style="list-style-type: none"> <li>• C—O absorption (at 1250-1000) only found in pentanol/alcohol</li> <li>• C—O absorption (at 1250-1000) found in pentanol but not in pentane or pentene</li> <li>• O—H absorption (at 3600-3200) only found in pentanol/alcohol</li> <li>• O—H absorption (at 3600-3200) found in pentanol but not in pentane or pentene</li> </ul> ignore reference to other absorptions			1	1		
				<b>Question 4 total</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>4</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			<p>1.21 (3) <b>must</b> be to 2 decimal places</p> <p>if incorrect credit any correct steps in method</p> <p><math>n(\text{H}_2\text{SO}_4) = 0.4 \times \frac{25}{1000} = 0.01</math> (1)</p> <p>2:1 ratio so <math>n(\text{NaOH}) = 0.02</math> (1)</p> <p><math>[\text{NaOH}] = \frac{0.02}{\frac{16.5}{1000}} = 1.21</math> (1)</p> <p>or using alternative method</p> <p><math>V_{\text{alkali}} C_{\text{alkali}} = 2V_{\text{acid}} C_{\text{acid}}</math> (1)</p> <p><math>C_{\text{alkali}} = \frac{2 \times 25.0 \times 0.40}{16.5}</math> (1)</p>		3		3	3	3
	(b)			<p>24.24 / 24.2 (2) <b>must</b> be minimum 3 sig figs</p> <p>if incorrect award (1) for correct step in method</p> <p><math>m(\text{NaOH}) \text{ in } 500\text{cm}^3 = 1.21 \times 0.5 \times 40</math></p> <p>ECF possible from part (a)</p>		2		2	2	2
				<b>Question 5 total</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>5</b>

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	<p><b>Indicative content</b></p> <p><i>AO1 allocation</i></p> <ul style="list-style-type: none"> <li>• in copper(II) chloride <ul style="list-style-type: none"> <li>○ cathode <math>\Rightarrow</math> <math>\text{Cu}^{2+}</math> ions / copper forms</li> <li>○ anode <math>\Rightarrow</math> <math>\text{Cl}^-</math> ions / chlorine forms</li> </ul> </li> <li>• in sodium chloride <ul style="list-style-type: none"> <li>○ cathode <math>\Rightarrow</math> <math>\text{H}^+</math> ions / hydrogen gas forms</li> <li>○ anode <math>\Rightarrow</math> <math>\text{Cl}^-</math> ions / chlorine forms</li> </ul> </li> <li>• product formed at the cathode depends upon the reactivity of the metal compared to hydrogen such that <ul style="list-style-type: none"> <li>○ if the metal is less reactive than hydrogen – the metal will form</li> <li>○ if the metal is more reactive than hydrogen – hydrogen gas will form</li> </ul> </li> </ul> <p><i>AO2 allocation</i></p> <ul style="list-style-type: none"> <li>• in copper(II) chloride <ul style="list-style-type: none"> <li>○ <math>\text{Cu}^{2+}</math> ions gain electrons and are reduced and <math>\text{Cl}^-</math> ions lose electrons and are oxidised</li> <li>○ <math>\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}</math></li> </ul> </li> <li>• in sodium chloride <ul style="list-style-type: none"> <li>○ <math>\text{H}^+</math> ions gain electrons and are reduced</li> <li>○ <math>2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2</math></li> </ul> </li> <li>• in both solutions <ul style="list-style-type: none"> <li>○ <math>\text{Cl}^-</math> ions lose electrons and are oxidised</li> <li>○ <math>\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}</math></li> <li>○ <math>2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-</math></li> </ul> </li> </ul>	4			6		2



Question				Marking details								
				<p><b>5-6 marks</b> Comprehensive description of the electrolysis of both solutions; description of reduction and oxidation in terms of electrons; explanation why hydrogen rather than sodium forms with sodium chloride solution <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</i></p> <p><b>3-4 marks</b> Basic description of the electrolysis of both solutions; some understanding of movement of ions and gain/loss of electrons; explanation why chlorine forms with both solutions <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</i></p> <p><b>1-2 marks</b> Simple description of movement of ions and gain/loss of electrons in one solution <i>There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p><b>0 marks</b> <i>No attempt made or no response worthy of credit.</i></p>								
				<b>Question 6 total</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>2</b>		

## FOUNDATION TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	6	3	10	0	10
2	1	2	2	5	1	5
3	5	4	0	9	0	9
4	5	7	3	15	8	15
5	6	0	0	6	0	4
6	6	5	4	15	4	0
<b>TOTAL</b>	<b>24</b>	<b>24</b>	<b>12</b>	<b>60</b>	<b>13</b>	<b>43</b>

## HIGHER TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	5	4	15	4	0
2	2	9	5	16	7	14
3	9	2	0	11	0	11
4	3	1	3	7	0	4
5	0	5	0	5	5	5
6	4	2	0	6	0	2
<b>TOTAL</b>	<b>24</b>	<b>24</b>	<b>12</b>	<b>60</b>	<b>16</b>	<b>36</b>