GCSE MARKING SCHEME

SUMMER 2024

GCSE
SCIENCE (DOUBLE AWARD)
UNIT 2: CHEMISTRY 1

3430U20-1 AND 3430UB0-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCSE SCIENCE (DOUBLE AWARD) UNIT 2 – CHEMISTRY 1

SUMMER 2024 MARK SCHEME

GENERAL INSTRUCTIONS

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

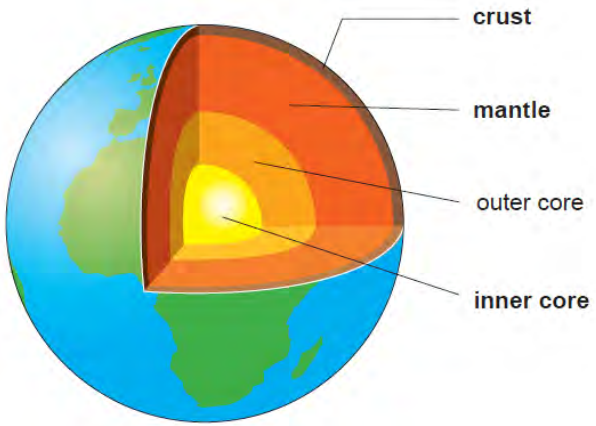
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide 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.

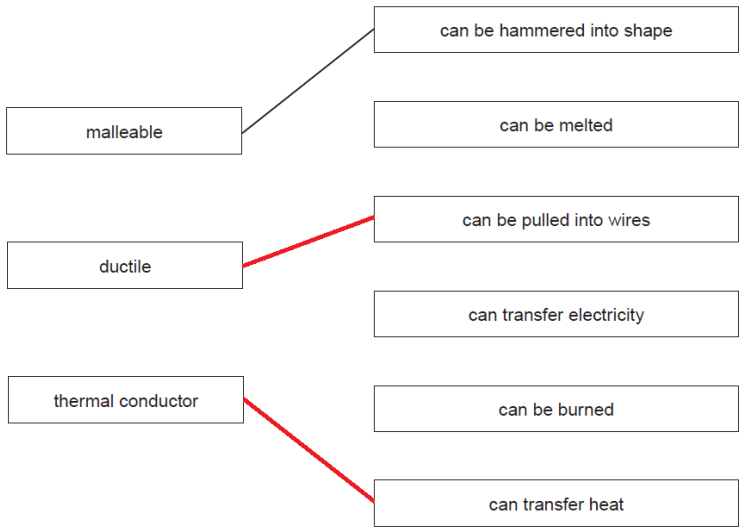
Marking abbreviations

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

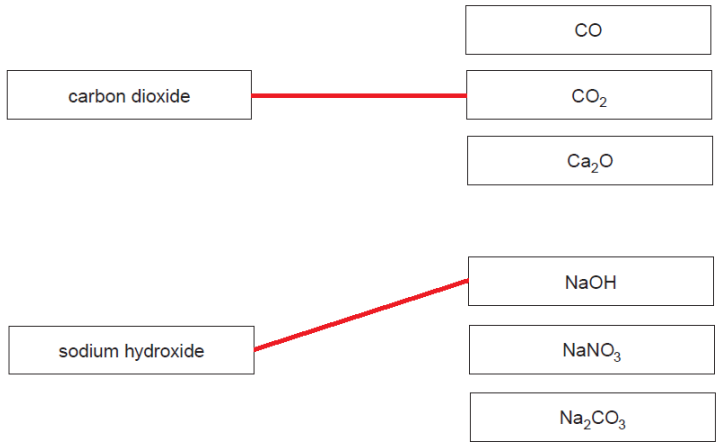
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

FOUNDATION TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			 award (2) for **all** three correct award (1) for any **one** correct	2			2		
	(b)			award (1) for each correct answer rocks coastlines moved	3			3		
	(c)			plates	1			1		
				Question 1 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		**B**		1		1		
		(ii)		**C**		1		1		
		(iii)		**A / D**		1		1		
	(b)			 award (1) for each correct line do not award credit if more than one line from property	2			2		2
				Question 2 total	**2**	**3**	**0**	**5**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			award (1) for each advantage strengthens bones and teeth reduces risk of heart disease	2			2		
	(b)			boiling	1			1		1
	(c)			**Z**			1	1		
				Question 3 total	**3**	**0**	**1**	**4**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			 award (1) for each correct line	1	1		2		
	(b)			MgO do not accept MGO		1		1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			136 (2) if incorrect award (1) for any of following 40 + 32 + 64 40 + 32 + (4 × 16) (1 × Ca) + (1 × S) + (4 × O)		2		2	2	
	(d)			$2\,Al + \boxed{3}\,Cl_2 \longrightarrow 2\,AlCl_3$		1		1		
				Question 4 total	**1**	**5**	**0**	**6**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		neither model has any neutrons ☐ Thomson had electron shells in his model ☐ Thomson did not think atoms are mostly empty space ✓			1	1		
		(ii)		electrons are in shells outside the nucleus ☐ atoms have equal numbers of protons and electrons ☐ atoms have equal numbers of protons and neutrons ✓			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		electrons are outside the nucleus ✓ electrons are inside the nucleus there are more protons than electrons in an atom protons are in a nucleus in the centre of an atom ✓ atoms have particles with no charge ✓ award (2) for **three** correct award (1) for **two** correct (and one incorrect) deduct (1) for any additional incorrect answer			2	2		
	(b)			13 protons (1) 14 neutrons (1)		2		2		
				Question 5 total	**0**	**2**	**4**	**6**	**0**	**0**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td></td><td>beaker ☐
thermometer ☐
gas syringe ✓
conical flask ☐</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>
<table>
<tr><th rowspan="2">Concentration of acid (M)</th><th colspan="4">Volume of gas produced (cm^3)</th></tr>
<tr><th>Test 1</th><th>Test 2</th><th>Test 3</th><th>Mean</th></tr>
<tr><td>0.2</td><td>16</td><td>14</td><td>15</td><td>15</td></tr>
<tr><td>0.4</td><td>31</td><td>33</td><td>30</td><td>32</td></tr>
<tr><td>0.6</td><td>47</td><td>49</td><td>29</td><td>48</td></tr>
<tr><td>0.8</td><td>63</td><td>64</td><td>65</td><td>64</td></tr>
<tr><td>1.0</td><td>82</td><td>83</td><td>79</td><td>81</td></tr>
</table>
award (1) for identifying 29

award (1) for reason e.g.
it is too far away from the others (at that concentration)
it is an anomaly
it is too far from the mean
it is too low / it is much lower than the others

neutral answers – it is lower (than the others) / unreliable / incorrect</td><td></td><td></td><td>2</td><td>2</td><td></td><td>2</td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		award (2) for **all** five points plotted correctly (±1 square) award (1) for any **three** correct points award (1) for straight line		2	1	3	3	3
		(iii)		40 accept any value in the range 39-41 ecf possible from incorrect line (±1 square)		1		1	1	
	(c)			there are more particles of acid ☐ the acid particles are moving faster ✓ there is a higher surface area ☐ there are more collisions per second ✓ the acid particles have less energy ☐ award (1) for each correct answer deduct (1) for each additional tick if more than two ticks		2		2		2
	(d)			hydrogen accept H_2	1			1		1
				Question 6 total	**2**	**5**	**3**	**10**	**4**	**9**

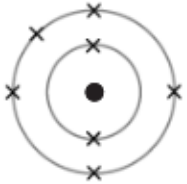
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**Indicative content** **sedimentation** • water is left to stand in tanks / move slowly through tanks • large insoluble particles removed e.g. sand / silt / microplastics • particles sink to the bottom / particles are removed by gravity **filtration** • water is passed through sand / gravel • smaller insoluble particles removed e.g. sand / silt / microplastics **chlorination** • chlorine is added to kill bacteria / viruses • prevents disease e.g. cholera / typhoid / norovirus reference to **screening** (removing large objects using coarse screens) and **fluoridation** are neutral – no credit do not consider them as irrelevant	6			6		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				5-6 marks Description showing good knowledge of all three stages (in the correct order) and their purpose *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.* **3-4 marks** Basic knowledge of most of the process *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.* **1-2 marks** Some knowledge of one or two stages of the process *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.* **0 marks** *No attempt made or no response worthy of credit.*						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		award (1) for any of following to <u>strengthen</u> teeth / (tooth) enamel to reduce tooth decay / DMFT to reduce fillings (cavities) neutral answers to make your teeth better / healthier / healthy / cleaner good for your teeth	1			1		
		(ii)		award (1) for any of following • it is mass medication / you don't have a choice / the council (or government) decide for you • it causes (dental or skeletal) fluorosis / it makes your teeth yellow • you can get enough (fluoride) in toothpaste or tablets • if you have tablets or (fluoride) toothpaste as well you can have too much fluoride • it is possibly linked to stomach problems / brittle bones / infertility / kidney problems neutral answers it causes cancer / disease it is toxic / poisonous	1			1		
				Question 7 total	**8**	**0**	**0**	**8**	**0**	**0**

COMMON QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)	(i)		lithium			1	1		
		(ii)		accept any answer in range 32-46		1		1	1	
		(iii)		lithium no credit if more than one metal given			1	1		
	(b)			award (1) for observation • (lilac) flame • it ignites / burns accept 'it sparks' • it is more exothermic neutral answers – moves faster / fizzes more award (1) for reason • potassium (it) is <u>more reactive</u> (than sodium) • potassium is higher in the reactivity series (than sodium) • Group 1 <u>reactivity</u> increases down the group • outer electron is further from the nucleus (in potassium) neutral answers (ambiguous with no reference to the group or reactivity series) potassium is below / lower than sodium potassium is above / higher than sodium	2			2		2
	(c)			$4\,Li + O_2 \rightarrow 2\,Li_2O$ award (1) for product award (1) for balancing **only if product correct**		2		2		
				Question 8/1 total	**2**	**3**	**2**	**7**	**1**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	(a)			**A** and **C** both needed		1		1		
	(b)			20 (1) calcium (1) accept Ca no ecf possible		2		2		
	(c)			 must show inner shell with 2 electrons **and** outer shell with 5 electrons electrons can be in any position on shells accept 2.5 / 2,5 written with no diagram accept diagram with no nucleus		1		1		
				Question 9/2 total	**0**	**4**	**0**	**4**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/3	(a)			award (1) each for any **two** of following • **J** has a lower boiling point (than **K**) / **J** has the lower boiling point / **J** is lower (than **K**) • **J** has a boiling point of 56°C / **J** is boiling at 56°C • **K** has a higher boiling point than 56°C / **K** is higher than 56°C penalise only once if reference to melting point rather than boiling point			2	2		2
	(b)			67 (2) accept 66.7 if answer incorrect award (1) for any of following 4 × C (4 × 12) 48		2		2	2	
				Question 10/3 total	**0**	**2**	**2**	**4**	**2**	**2**

HIGHER TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		$Mg + \boxed{2} HNO_3 \longrightarrow Mg(NO_3)_2 + H_2$ award (1) for formula of salt award (1) for formula of hydrogen gas and correct balancing **only if salt formula is correct**		2		2		
		(ii)		award (2) for **all** six points plotted correctly (±½ square) award (1) for any **four** correct points award (1) for smooth curve		2	1	3	3	3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		credit any **three** of the following four award (1) for any of following • rate decreases • reaction gets slower • rate is greatest at the start • reaction is fastest at the start award (1) for any of following • reactant particles are used up (over time) • concentration of reactants decreases (over time) • there are fewer reactant particles (over time) • there are more reactant particles at the start award (1) for any of following • there are fewer (successful) collisions per second • the frequency of (successful) collisions is lower • there is less chance of (successful) collisions • less hydrogen is produced award (1) for any of following • line levels out when reaction has finished / all the particles have reacted • particles (of metal / acid) have all been used up at 25s • reaction has finished at 25s / 35cm^3	3			3		3
	(b)			(catalysts) increase the rate of a reaction / speed up a reaction / make a reaction faster (1) by lowering the activation energy / by lowering the energy needed for successful collisions (1)	2			2		2
				Question 4 total	**5**	**4**	**1**	**10**	**3**	**8**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		the pressure is higher than at sea level and the temperature is lower ✓ the pressure and temperature are both lower than at sea level particles are closer together at a higher pressure ✓ carbon dioxide is not a gas at any temperature or pressure particles are closer together at a higher temperature award (1) for each correct answer deduct (1) for each additional tick if more than two ticks			2	2		
		(ii)		award (1) each for any **two** sensible answers e.g. • proposal 2 makes **use** of the captured carbon dioxide (whereas it is only stored in proposal 1) – accept named uses • proposal 1 creates huge technical / engineering challenges • proposal 1 could lead to leakage of carbon dioxide (back to atmosphere / into the ocean) • proposal 1 creates plastic waste			2	2		
	(b)			$CO_2 + NaOH \rightarrow NaHCO_3$ award (1) for reactants award (1) for product deduct (1) if all formulae are correct but there has been an incorrect attempt to balance the equation		2		2		
				Question 5 total	**0**	**2**	**4**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** **Boiling** • boiling causes calcium hydrogencarbonate to decompose (or magnesium hydrogencarbonate) • a precipitate of calcium carbonate is formed (limescale) • calcium / magnesium ions are removed from the water • $Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2$ • very simple method of softening • but limescale is formed which causes 'furring' / reduces boiler efficiency / blocks pipes • boiling only removes temporary hardness • not for large-scale as it requires a lot of energy references to 'scum' are neutral **Ion exchange** • ion exchange columns contain a resin (in small balls) coated with sodium ions • as hard water passes through the column, sodium ions come off the resin and go into the water, while calcium / magnesium ions come out of the water and stick to the resin • removes both temporary and permanent hardness • continuous process • resin needs changing / regeneration • water contains high levels of sodium ions which can be harmful for some people	6			6		3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**5-6 marks** Good description of both methods with an advantage and/or disadvantage for each *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.* **3-4 marks** Basic description of both methods; reference to an advantage and a disadvantage *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.* **1-2 marks** Some knowledge of one method and/or its advantage/disadvantage *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.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 6 total	**6**	**0**	**0**	**6**	**0**	**3**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td></td><td>salt A potassium iodide accept KI

observation B brick red (flame)

observations C apple green (flame) and cream (precipitate)

award (1) for each correct row</td><td>2</td><td></td><td>1</td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td><table><tr><th>Ion</th><th>Number of protons</th><th>Number of electrons</th></tr><tr><td>Ca^{2+}</td><td>20</td><td>18</td></tr><tr><td>Br^{-}</td><td>35</td><td>36</td></tr></table>
award (1) for each correct row or column

no ecf from incorrect number of protons</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>$Ca^{2+} + CO_3^{2-} \rightarrow CaCO_3$

award (1) for reactants
award (1) for product (as long as an equation has been attempted)

ignore state symbols</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			110 (2) if answer incorrect award (1) for either of following 22 530 **and** 640 ecf possible from subtraction error		2		2	2	2
				Question 7 total	**4**	**4**	**1**	**9**	**2**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		award (1) for any of following • reactivity decreases down Group 7 • chlorine most reactive followed by bromine and then iodine • chlorine most reactive <u>and</u> iodine least reactive (accept reference to fluorine as most reactive) award (1) for any of following • it becomes harder to attract an electron • outer shell becomes further from the nucleus • more shielding	2			2		
		(ii)		award (1) for correct identification **X** chlorine **Y** iodine **Z** bromine award (1) for reasoning based on **observations** e.g. • chlorine reacts with sodium iodide and sodium bromide, (bromine reacts with sodium iodide only) and iodine reacts with none of the solutions • chlorine reacts with two solutions, (bromine reacts with one solution) and iodine reacts with none of them • two solutions change colour with chlorine, (one solution changes colour with bromine) and no solutions change colour with iodine • chlorine displaces bromine and iodine, (bromine displaces iodine) and iodine does not displace either of the other two			2	2		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			65 (2) if answer incorrect award (1) for either of following 325 (mass of $FeCl_3$ in equation) M_r $FeCl_3$ = 162.5 alternative method award (1) for either of following 0.4 mol Fe reacts 0.4 mol $FeCl_3$ forms ecf possible e.g. from incorrectly calculated M_r value		2		2	2	
	(c)			P_4 + 6 Cl_2 ⟶ 4 PCl_3		1		1		
				Question 8 total	**2**	**3**	**2**	**7**	**2**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		award (1) each for any **two** of the following less coal burned (in power stations) / cleaner coal cleaner coal / sulfur removed from coal before burning sulfur scrubbing / sulfur dioxide is trapped in chimneys before leaving factories neutral answers less fossil fuels burned more renewable energy sources	2			2		
		(ii)		less acid rain / rain less acidic (1) award (1) for any benefit for natural habitats e.g. • less destruction of forests • pH of lakes does not decrease	2			2		
	(b)			ratio of N : O atoms ⇨ $\frac{1.4}{14} : \frac{4.0}{16}$ (1) 0.1 : 0.25 (1) 2:5 ratio ⇨ N_2O_5 (1) award (2) for correct answer with no working ecf possible award (2) for N_5O_2 (where A_r divided by mass with working shown) award (1) for N_5O_2 with no working	1	2		3	3	
				Question 9 total	**5**	**2**	**0**	**7**	**3**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	0	0	**6**	**0**	**0**
2	2	3	0	**5**	**0**	**2**
3	3	0	1	**4**	**0**	**1**
4	1	5	0	**6**	**2**	**0**
5	0	2	4	**6**	**0**	**0**
6	2	5	3	**10**	**4**	**9**
7	8	0	0	**8**	**0**	**0**
8	2	3	2	**7**	**1**	**2**
9	0	4	0	**4**	**0**	**0**
10	0	2	2	**4**	**2**	**2**
TOTAL	**24**	**24**	**12**	**60**	**9**	**16**

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	3	2	**7**	**1**	**2**
2	0	4	0	**4**	**0**	**0**
3	0	2	2	**4**	**2**	**2**
4	5	4	1	**10**	**3**	**8**
5	0	2	4	**6**	**0**	**0**
6	6	0	0	**6**	**0**	**3**
7	4	4	1	**9**	**2**	**5**
8	2	3	2	**7**	**2**	**1**
9	5	2	0	**7**	**3**	**0**
TOTAL	**24**	**24**	**12**	**60**	**13**	**21**