GCSE Science – Investigative Skills Assignment – Marking Guidelines
Chemistry 2.2 – Electrolysis
For use until May 2009
Last date for submission for moderation May 2010

Please mark in red ink, and use one tick for one mark. Each part of each question must show some red ink to indicate that it has been seen.

Subtotals for each part of each question should be written in the right hand margin.

Please add annotations where necessary to explain why marks have or have not been awarded.

Enter the marks for **Section 1** and **Section 2** and the **total mark** on the front cover of the answer booklet.

The teacher must sign and date the front cover of the ISA.

The papers must be kept in a secure place and must **not** be returned to candidates.

The marking guidelines show examples of typical responses that candidates may make. However, teachers should use their professional judgement in deciding whether or not to award marks. If, in the judgement of the teacher, the candidate has provided a response which correctly answers the question, then a mark should be awarded even if this response is not shown in the mark guidance. If necessary, the teacher should annotate the script and/or mark guidance to justify the decision.

In the mark guidance:

- the use of a solidus (/) indicates an alternative answer

- the use of brackets ( ) indicates wording that is not essential in the candidate's answer, but makes the guidance clearer.

SECTION 1

	Answer	Additional Guidance	
1	Statement referring to change in the dependent variable eg to see how the change in the mass of copper **deposited** (on the negative electrode / cathode) **or** eg to see how the change in the volume of gas produced	Dependent variable must be identified Just mass of copper alone is **not** sufficient Just volume of gas alone is **not** sufficient	1 mark
	Independent variable correctly identified and linked to dependent variable eg depends on the: - current used - time taken - area of electrodes		1 mark
2(a)	Any one from: eg - current used - time taken - area of electrodes	Depends on independent variable chosen	1 mark
(b)	Explanation of how the variable was kept constant	Answer must be from candidate's own investigation	1 mark

		Answer	Additional Guidance	
2(c)		The mass of copper deposited / volume of gas produced depends on : • current used • time taken • area of electrodes immersed	Accept it will also affect the mass of copper deposited / volume of gas given off	1 mark
3		Ring around continuous	Accept other unambiguous indication	1 mark
4(a)		Any **one** from: eg • stopwatch • ammeter • voltmeter • balance • a measuring cylinder		1 mark
(b)		The measurements would have been more precise		1 mark
5		Recognition of spread / scatter / random errors	eg anomalies / random errors are more obvious / can be recognised Accept wide spread suggests a lack or reliability	1 mark
		Further explanation of spread / scatter / random errors and its affect on reliability	eg calculating the mean when there are many repeats reduces the affect of random errors Accept anomalous results can be left out when calculating the mean	1 mark
6		Amplified statement relating the dependent and independent variables eg the mass of copper deposited **increases** for **1** mark **plus** as the time taken / current used **increases** for **2** marks **or** eg the mass of copper deposited does not depend on the time taken / current used for **1** mark **plus** as the results do not show a trend / are random for **2** marks eg Mass of copper increases as the time taken / current value increases for **1** mark Similar statements for the volume of gas produced	**NB** the statement **must** relate to the candidate's own work Simple correct statement for **1** mark only eg the mass of copper deposited depends on the time taken / current used for **1** mark **or** the mass of copper deposited does not depend on the time / current used does not show a trend / is random for **1** mark	2 marks

	Answer	**Additional Guidance**	
7	**Table:** Correct headings AND units all correct for all measured variables	Table with incomplete headings or units for the measured variables gains **1** mark eg all headings present = 1 eg all units present = 1	2 marks
	Graph/chart: X axis: suitable scales chosen and labelled with quantity and units	Accept axes reversed	1 mark
	Y axis: suitable scales chosen and labelled with quantity and units		1 mark
	Points or bars plotted correctly to within ± 1mm	Allow **one** plotting error out of every 5 points plotted. Allow error carried forward from incorrect plots	1 mark
	Suitable line drawn on graph or bars correctly labelled on bar chart		1 mark
	If wrong type of graph / chart, maximum **3** marks		
	If the independent variable is: *continuous* *categoric* *discrete*	should draw a *best fit line graph* should draw a *bar chart* may draw either a *best fit line graph* or a *bar chart* (but allow dot-to-dot joining of points in this case)	
			Max 18 marks

SECTION 2

	Answer	**Additional Guidance**	
8(a)	5		1 mark
(b)	from 5 to 25		1 mark
9	2.37	2.46 gains **1** mark Accept answer written in the table or elsewhere	2 marks
10	Line graph		1 mark
11	Any **two** from: eg • gold / silver are valuable elements • gold / silver can be economically extracted from the sludge • arsenic is a poisonous element • arsenic should not be released into the environment		2 marks

	Answer	**Additional Guidance**	
12(a)	It was less than expected		1 mark
	At currents greater than 200 amps	Accept: at high currents	1 mark
(b)	Small particles (of copper)		1 mark
(c)	200		1 mark
	Above 200 amps the copper yield is less than 100%	Accept not all of the copper is sticking to the negative electrode / cathode	1 mark
13	Correct reason given Any **one** from: eg **Yes –** • steel has the highest (relative) strength • steel is the least expensive **No –** • copper may be difficult to remove from the steel electrode • copper may be contaminated by the steel • no need to separate copper if a copper electrode is used	No mark for **Yes** or **No** mark is for the reason	1 mark
14	Any **two** from: eg • electricity has to be generated which often causes pollution • the copper sulfate solution used must be disposed of safely • impurities must be disposed of	eg by burning fossil fuels from nuclear power	2 marks
	Quality of written communication Candidates should use at least **two** technical terms from: eg • electrolysis • pollution • fossil fuels (or examples) • nuclear • hydroelectric • impurities • contaminated	The mark is to be awarded for the **correct** use of these terms The marker should circle these terms Annotate below candidate's answer with *Q✓ for mark given or Q✗ for mark not given*	1 mark
		Max 16 marks	
		ISA Total 34 Marks	