H

…day June 20XX – Morning/Afternoon

GCSE (9–1) Chemistry B (Twenty First Century Science)

J258/04   Depth in chemistry (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK   90

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.
   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

    Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

    The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
    The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

    In summary:

    The skills and science content determines the level.
    The communication statement determines the mark within a level.

    Level of response questions on this paper are **2(b)(ii)** and **8(b)***.

11. **Annotations**

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
——	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9−1) in Chemistry B:

	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.
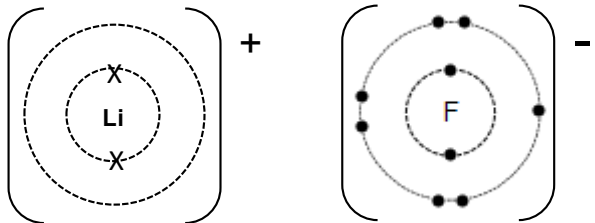
Question			Answer	Marks	AO element	Guidance
1	(a)		gaps are for undiscovered elements ✓ he predicted properties / new elements matched his predictions / new elements had the properties he predicted ✓	2	1.1	
	(b)		d and Zn / cadmium and zinc ✓ transition metals ✓	2	2.1	Both elements needed for one mark

Question			Answer	Marks	AO element	Guidance
2	(a)		volume of acid✓ temperature of acid ✓ mass of magnesium✓ surface area of magnesium ✓ correct link between increase in rate of reaction and factor (e.g. if surface area is greater, rate increase) ✓	5	1.2	
	(b)	(i)	(1.50) 5+6+6 /3=5.7(to two sig figs) ✓ (2.00) 6+7+6 /3 =6.3 (to two sig figs) ✓ Both values round to 6 (to one sig fig) ✓	3	2.2	**ALLOW** 5.67 etc if correctly rounded (last number must be 7)

		(ii)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.
			
			Level 3 (5–6 marks)
			Correctly evaluates the quality of the data as being poor with valid reasons.
			And
			Makes several correct suggestions for the development of the method with correct explanation of how the data will be improved.
			
			There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated
			
			Level 2 (3–4 marks)
			Correctly evaluates the quality of the data as being poor with valid reasons.
			And
			Makes several correct suggestions for the development of the method or makes one suggestion with a correct
				6	2 x 3.1b
					2 x 3.3a
					2 x 3.3b
						Indicative scientific points may include
						AO3.1b evaluation of the quality of Joe's results.
						For example
						  • no spread of data
						  • results too close together
						  • volumes measured very small
						
						AO3.3a suggestions for the development of Joe's method
						For example
						  • increase time before volume measured
						  • increase volume of acid
						  • increase surface area of magnesium
						  • more magnesium
						
						AO3.3b explanation of how the data will be improved
						
						For example

Question			Answer	Marks	AO element	Guidance
			explanation of how the data will be improved. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** *Correctly evaluates the quality of the data as being poor with a valid reason.* ***And*** *Makes one suggestion for the development of the method with no explanation.* *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.			• volume of gas will be greater • more precise measurement of volume • larger spread of data • less overlap of ranges

Question			Answer	Marks	AO element	Guidance
3	(a)		floods, storms, global temperatures or carbon emissions show an increase ✓ idea of similar or <u>same pattern</u> in increase in storms and carbon emissions ✓ identifies similarity in <u>rate</u> of changes / since 1950 far greater increase in carbon emission and global temperature ✓	3	2.1	
	(b)		future global carbon emissions are not definite / not known ✓ idea that predictions are uncertain from extrapolated data / cannot be certain about factors in the future / cannot be certain about a named factor e.g. atmospheric composition / effect of increased water vapour or other ✓	2	2.1 2.2	
	(c)	(i)	gives an approximation of increase in floods /quotes numbers from graph of floods / less than 50 to almost 200 / about 400% ✓ during same period (since 1970) only about 1°C temperature increase / about 3.5% ✓ (conclusion) Idea that floods <u>percentage</u> increase is in multiples / much greater than 100% and that <u>percentage</u> increase in temperature is small ✓	3	3.1a 3.1a 3.2a	

Question			Answer	Marks	AO element	Guidance
		(ii)	risk from floods is increasing more/faster than global temperature ✓	3	3.1a	
			(don't agree because) overall risk of harm from floods is still small ✓		3.2b	
			(don't agree because) idea that risk of increased temperature is far greater/ names issue such as crop failure/weather pattern changes ✓		3.2b	
	(d)		explains positive benefits: **Any <u>two</u> points from**	4		**must be clearly linked to idea of benefit or cost.**
			uses waste CDs ✓			copied statements from question alone do not score.
			carbon dioxide from burning fossil fuels can be stored ✓		3.1b	for two benefits award one mark
			also can be used to absorb toxic gases ✓			for two drawbacks award one mark
			in the future other plastic waste may be used ✓			
			saves space in landfills ✓			
			idea of recycling / saves using crude oil to make material ✓			
			explains costs /drawbacks: **Any <u>two</u> points from**			
			cost of development is high ✓		3.1b	
			may be other developments which would have a bigger effect ✓			
			not enough CDs/ idea that this is a small scale process / will run out ✓			
			judges overall outcome:			
			makes a decision (yes/no) and justifies it in terms of relative size of benefit and cost ✓		3.2a	
					3.2a	

Question			Answer	Marks	AO element	Guidance
			acknowledges uncertainty at judging future benefits and costs / cannot be sure of future outcomes ✓			

Question			Answer	Marks	AO element	Guidance
4	(a)		$2Li(s)$ $+$ $F_2(g)$ $\rightarrow$ $2.LiF(s)$ state symbols ✓ chemical symbols ✓ balancing ✓	3	 1.1 1.1 1.2	**ALLOW** $Li(s) + \frac{1}{2}F_2(g) \rightarrow LiF(s)$
	(b)		lithium: 2 electrons ✓ fluoride ion: 10 electrons in the arrangement 2, 8 ✓ both charges correct Li^+ and F^- ✓ 	3	1.2	
	(c)		simple covalent substances have lower MP and BP than ionic compounds ✓ idea that forces between molecules of simple covalent substances are weak ✓	3	2.1	**IGNORE** reference to size

Question			Answer	Marks	AO element	Guidance
			idea that attraction between ions in ionic compounds are strong ✓			

Question			Answer	Marks	AO element	Guidance
5	(a)		do not conduct when solid but do when molten so ionic✓	2	1.1	
			have a high melting point so giant structure✓		2.1	
	(b)		both have giant structures as both have high melting points✓	4	1.1	
			A conducts electricity when solid or molten, **B** does not conduct electricity✓		2.1	
			therefore			
			A is a metal with a giant structure✓		3.2b	
			B is a covalent compound with a giant structure✓		3.2b	

Question			Answer	Marks	AO element	Guidance
6	(a)		ethane ✓ ratio C:H is 2:6 therefore empirical ratio of C:H is 1:3 ✓	2	2.2	
	(b)		C_4H_{10} ✓ butane ✓	2	1.1 1.2	
	(c)		shows a formula with 8 carbon and 18 H atoms ✓ fully correctly displayed with 4 bonds around each C atom ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
7	(a)		$4Fe(s) + 6 H_2O(l) + 3O_2(g) \longrightarrow$ $2Fe_2O_3.3H_2O(s)$ ✓✓	2	1.1	One mark for 2 or 3 right Two marks for all 4 right **ALLOW** **$2Fe(s) + 3H2O + 1\frac{1}{2} O2(g) \longrightarrow$** **(1)Fe2O3.3H2O(s)**▢
	(b)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 33 (g) award 5 marks.** 7x5 = 35 = mass of steel in ball bearings 35x 0.995 = 34.825g of Fe 34.825 ÷ 2 = 17.4125 amount of iron turned to rust ✓ RAM Fe = 55.8 RMM rust = 213.6 ✓ therefore number of moles of Fe = 17.4125 ÷ 55.8 ✓ ratio of Fe:Rust is 2:1 therefore number of grams of rust = $\dfrac{17.4125 \times 213.6}{55.8 \times 2}$ ✓ = 33.327 = 33 (g) ✓	5	 2.2 1.2 2.2 2.2 1.2	

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 2.1 (%) award 3 marks** mass of rust = 4 x 33 = 132 g mass of iron converted to rust = 4 x 17.4125 = 69.65 increase in mass = 132 – 69.65 = 62.35g ✓ % increase = $\frac{62.35}{3000}$ x 100 = 2.078333… ✓ = 2.1(%) to 2 sig figs ✓	3	2.2	**ALLOW ECF** from **(b)(i)**
	(c)		rust is loose so stops the bearings turning the wheels / jams the bearings ✓ one solution from: coat/galvanise/grease ball bearings to form barrier to keep the water and oxygen from the steel ✓ use another material with the same desirable properties but that does not rust/suggestion of an alternative material such as ceramic ✓	2	2.1 1.1	

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 0.03 (mol/dm²) award 2 marks** RFM of NaCl = 23.0 + 35.5 = 58.5 ✓ therefore $\dfrac{1.755}{58.5}$ = 0.03 (mol/dm²) ✓	2	2.2	
		(ii)	draw start line with pencil ✓ put a dot of dye on start line ✓ add sodium chloride/solvent to beaker / put paper into solvent ✓ make sure solvent is below level of dot ✓	4	1.2	all points may be scored from a clearly labelled diagram

Question		Answer	Marks	AO element	Guidance
(b)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** *Shows correct understanding of output of the chromatogram and calculates correctly the Rf of each spot, including linking the Rf values to the table of food dyes, leading to identification of issues.* ***And*** *makes correct conclusions about the jelly* ***And*** *Suggests improvements to increase confidence in the result.* *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** *Shows correct understanding of output of the chromatogram and calculates correctly the Rf of some of the spots, including linking the Rf values to the table of food dyes.* ***And*** *makes some conclusions about the jelly or suggests improvements.* *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	6	2 x 1.2 2 x 2.2 3.2b 3.3b	**Indicative scientific points may include** **AO3.2b: making conclusions about the dye dyes by comparing results with table of Rf values** For example - not clear result - one spot possibly a safe dye - possibly two banned dyes - cannot be exported to USA **AO2.2: directly linking spots Rf values** For example - calculates the Rf of dyes: 0.22/ 0.25/ 0.88 - noticed two spots that have very close Rf values and have merged into one spot - comments on difficulty of calculating the Rf of the all spots - compares spots with table **AO1.2: understanding of the output from a chromatogram** For example - jelly contains 3 dyes - shows how to calculate RF value **AO3.3b: making improvement to increase confidence** For example - use a different solvent - suggest a different method

Question			Answer	Marks	AO element	Guidance
			Level 1 (1–2 marks) *Shows correct understanding of output of the chromatogram and calculates correctly the Rf of some of the spots.* *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** No response or no response worthy of credit.			

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	carbon dioxide ✓	1	1.1	
		(ii)	H_2: 4 x 24 = 96 dm^3 ✓ CO_2: 1 x 24 = 24 dm^3 ✓	2	2.2	**ALLOW** clear indication of 4 <u>moles</u>:1 <u>mole</u> ratio in calculation for (1) mark
		(iii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 15.38 award 3 marks** 8 / 52 x 100 = 15.4 / 15.38 % uses 8 in calculation ✓ uses 52 in calculation ✓ substitutes and computes correctly ✓	3	2.2	**ALLOW** any number of (correct) sig figs correct answer scores (3)
		(iv)	hydrogen has a low (relative atomic) mass ✓ all gases have the same (molar) volume / mass of carbon dioxide is much greater than hydrogen ✓	2	2.1	
	(c)		methane is a fossil fuel / in finite supply ✓ waste product is carbon dioxide ✓ carbon dioxide causes climate change ✓ idea that process cannot continue without causing harm to the environment / cannot continue because raw materials will not be available ✓	4	2.1 2.1 2.1 3.2b	

Summary of updates

Date	Version	Change
May 2018	2	We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information, please see our assessment principles in our "Exploring our question papers" brochures on our website
October 2019	2.1	Question 4 (a) – There has been a change to the Mark Scheme. Addition to guidance column: **ALLOW** $Li(s) + \frac{1}{2}F_2(g) \rightarrow LiF(s)$ Question 7 (a) – There has been a change to the Mark Scheme. Addition to guidance column: **ALLOW $2Fe(s) + 3H_2O + 1\frac{1}{2} O_2(g) \longrightarrow (1)Fe_2O_3 . 3H_2O(s)$** ✓