OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

GCSE (9–1) Chemistry A (Gateway Science)
J248/04 Paper 4 (Higher Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 90

This document consists of 24 pages

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.

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.

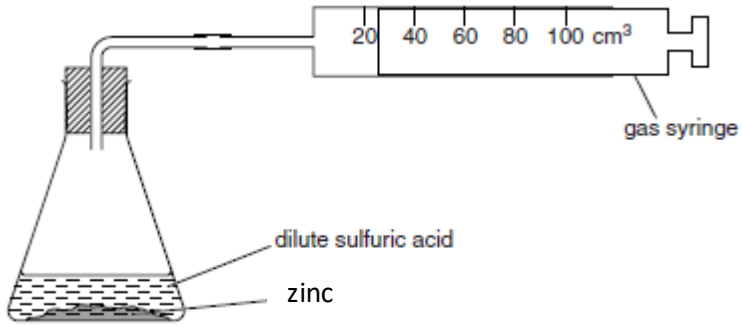
The breakdown of Assessment Objectives for GCSE (9–1) in Chemistry A:

	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.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	D	1	1.1	
2	C	1	2.1	
3	D	1	2.1	
4	D	1	1.2	
5	D	1	2.1	
6	C	1	2.1	
7	C	1	2.1	
8	B	1	2.2	
9	D	1	1.2	
10	D	1	1.1	
11	B	1	1.1	
12	A	1	2.2	
13	D	1	1.2	
14	D	1	1.2	
15	D	1	1.1	

SECTION B

Question			Answer	Marks	AO element	Guidance
16	(a)		Suitable container for the reactants e.g. flask, boiling tube or test tube (1) Use of a gas syringe / upturned burette with water in trough of water / upturned measuring cylinder with water in trough of water (1) The method actually works (1)	3	3.3b	
	(b)	(i)	To allow a comparison between with and without the added substance (1)	1	2.2	
		(ii)	Idea that the rate of reaction will change if concentration is changed (1)	1	2.2	It is a fair test is not sufficient **ALLOW** if concentration is increased the rate of reaction is increased **ALLOW** to ensure there are the same number of acid particles present / same number of acid particles per unit volume
		(iii)	Copper Because the reaction is faster (1) There is no change in appearance (1)	2	3.2b	**No** marks for copper on its own If substance other than copper given then 0 marks for the question
		(iv)	Measure mass of catalyst before and after (1)	1	3.3b	
		(v)	(Relative rate) between above 1 and below 10 because of smaller surface area	2	2.2	**No** marks for the prediction on its own **No** marks for whole question if prediction incorrect

Question			Answer	Marks	AO element	Guidance
			/ less exposed particles / less collisions (2)			
17	(a)	(i)	Molecular formula: At_2 (1) Atomic radius: 148 – 168 (1)	2	2.1	**DO NOT ALLOW** AT_2 / At2 **ALLOW** any range of numbers provided it is completely within the range given for the answer
		(ii)	Makes iodine and sodium bromide (1)	1	2.1	
		(iii)	Bromine is more reactive than iodine (1)	1	2.1	**ALLOW** ORA
	(b)	(i)	Same number of electrons in outer shell / all have 7 electrons in outer shell (1)	1	1.1	**ALLOW** outer electrons or valence electrons rather than electrons in the outer shell **ALLOW** valence shell rather than outer shell **DO NOT ALLOW** the wrong number of electrons in the outer shell
		(ii)	2Na + Br_2 → 2NaBr Correct formulae of reactants and products (1) Balancing – depend on correct formulae (1)	2	2.1	**ALLOW** any correct multiple of the equation including fractions **ALLOW** = or ⇌ instead of → **DO NOT ALLOW** and or & instead of + **ALLOW** one mark for correct balanced equation with minor errors of case and subscript e.g. 2NA + Br2 → 2NaBr
		(iii)	KAt (1)	1	2.1	

Question			Answer	Marks	AO element	Guidance
18			Copper(II) ions – add aqueous sodium hydroxide (1) Gives a blue precipitate (1) Bromide ion – add aqueous silver nitrate followed by dilute nitric acid (1) Gives a cream precipitate (1)	4	1.2	**ALLOW** any soluble metal hydroxide / aqueous ammonia **ALLOW** blue solid / blue solid that redissolves into dark blue solution if ammonia is used
19	(a)		Mean titre = 17.1 (1) Because titration 1 is a rough estimate / titration 1 is an outlier / titrations 2 and 3 are identical (1)	2	3.1b 3.2b	**IGNORE** anything in the titration table
	(b)		Moles of acid = 0.00171 (1) Concentration of KOH = 0.0684 (1)	2	2.1	**ALLOW ECF** from incorrect titre / 0.100 × titre × 10^{-3} **ALLOW ECF** from incorrect moles providing answer is to 3 sig figs / moles÷volume
	(c)		M_r of KOH = 56.1 (1) Concentration of KOH = 3.84 (1)	2	2.1	**ALLOW** correct answer without working **ALLOW** 3.837 **ALLOW ECF** from incorrect M_r and/or incorrect concentration from (b) / M_r × conc

Question			Answer	Marks	AO element	Guidance
20	(a)		Fractions have different boiling points (1) Idea that larger molecules have stronger intermolecular forces (1)	2	1.1	 Answer must be **comparative** **ALLOW ORA**
	(b)		Has a carbon-carbon double bond (1)	1	1.1	**ALLOW** has C=C **ALLOW** answer indicated on the displayed formula Has a double bond is not sufficient

Question			Answer	Marks	AO element	Guidance
21	(a)		Rate of forward reaction equals the rate of the backward reaction (1) Concentration of reactants and products do not change (1)	2	1.1	**ALLOW** concentration of reactant and product do not change **DO NOT ALLOW** concentration of reactant and products are the same
	(b)		Percentage yield = (actual yield ÷ predicted yield) × 100 / (2.2 ÷ 4.0) × 100 (1) 55 (1)	2	2.1	**ALLOW** full marks for answer with no working out

Question	Answer	Marks	AO element	Guidance
(c) *	*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)** **Describes and explains the effect of changing the temperature and pressure on the position of equilibrium in both theoretical terms and from the table and explains that one prediction is supported and the other prediction is not** *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)** **Describes and explains the effect of changing the temperature and pressure on the position of equilibrium in both theoretical terms and from the table** *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)** **Describes the effect of changing the temperature and pressure on the position of equilibrium in theoretical terms or describes the effect of changing the temperature and pressure on the position of equilibrium from the table** *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.*	6	2 x 1.1 2 x 3.1a 2 x 3.2b	**AO1.1: Knowledge of temperature and pressure on percentage yield** • As temperature increases the position of equilibrium shifts to the left in an exothermic reaction. • As pressure increases the position of equilibrium shifts to the side with the least number of moles of gas. • Decreasing the temperature of a system in dynamic equilibrium favours the exothermic reaction. **AO3.1a: Analyse information in the table to interpret equilibrium position** • As temperature increases the percentage yield decreases. • As temperature increases position of equilibrium moves to the left. • As the pressure increases the percentage yield increases. • As the pressure increases position of equilibrium moves to the right. **AO3.2a: Analyse information in the table/equation to make judgements/predictions** • The prediction is not supported since reaction must be exothermic rather than endothermic because position of equilibrium moves to the left as temperature increases. • The prediction is supported in terms of the moles of gas as pressure increases the position of equilibrium moves to the right. • The prediction is supported because as the pressure increases the percentage yield increases.

Question			Answer	Marks	AO element	Guidance
22	(a)		Endless supply of starting materials / no need to use solid raw materials to make fertilisers (1) Ammonia used to make fertilisers which increase crop yield (1)	2	1.1	**ALLOW** Haber Process used to convert atmospheric nitrogen into ammonia / Haber process involves the chemical fixation of ammonia (1)
	(b)	(i)	Rate increases More particles have energy above that of activation energy (1) More successful collisions (per second) (1)	2	1.1	**No** mark for rate increases but must be there to award two marks. Rate decreases give 0 marks for the question
		(ii)	Rate decreases Less particles per unit volume (1) Fewer collisions per second / decreased collision frequency (1)	2	1.1	**No** mark for rate decreases but must be there to award two marks. Rate increases give 0 marks for the question **ALLOW** less crowded particles **ALLOW** collisions less often

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	Titrate ammonia against sulfuric acid to obtain volumes needed for complete neutralisation (1) Add these volumes without the use of indicator (1) Slow evaporation of reaction mixture / heat reaction mixture over a steam bath (1) Burette and other chemical apparatus not suitable for using large quantities / very difficult to use a steam bath in the large scale (1)	4	1.2 1.2 1.2 2.1	 **ALLOW** heat neutral mixture with carbon or charcoal and then filter off carbon **ALLOW** Slow evaporation of filtrate / heat filtrate over a steam bath if method involving carbon is used
		(ii)	34 (g or tonnes) of ammonia makes 132.1 (g or tonnes) of ammonium sulfate / 17 (g or tonnes) of ammonia makes 66 (g or tonnes) of ammonium sulfate (1) So 51 tonnes makes 198.2 tonnes of ammonium sulfate (1)	2	2.1	**ALLOW** one mark for correct calculation of M_r for ammonia **AND** ammonium sulfate **IGNORE** units for the first marking point **ALLOW** one mark for 2 moles of ammonia makes 1 mole of ammonium sulfate

Question			Answer	Marks	AO element	Guidance
23	(a)		(900 000 ÷ 750 000) × 100 - 100 or ((900 000 – 750 000) ÷ 750 000) × 100 (1) 20 (1)	2	2.1	
	(b)		**ANY TWO FROM** Idea that insufficient data since none of the data refers to climate change or global temperature (1) Idea that the data itself is limited since it is for one city and not a global figure (1) % increase of carbon dioxide in the air is much less than increase in carbon dioxide emissions (1) Idea that the significant % increase of carbon dioxide emitted has had very little effect on the mean global temperature (1)	2	3.1a	**No** mark for no on its own

Question			Answer	Marks	AO element	Guidance
24	(a)		Leave for a longer period of time so that the results are more differentiated / keep at the same temperature because rate of reaction changes with temperature (1)	1	3.3b	**IGNORE** references to same mass of metals **ALLOW** same surface area of metal strip because surface area affects rate of reaction
	(b)		**ANY THREE FROM** Water is needed for corrosion (of most metals) since no corrosion in dry air but there is corrosion in moist air (1) Most metals corrode faster in moist alkaline air since more corrosion than in moist air (1) Most metals corrode faster in moist acidic air since more corrosion than in moist air (1) The rate of corrosion is not related to the reactivity series with reference to either copper or aluminium (1)	3	3.2b	

Question			Answer	Marks	AO element	Guidance
25	(a)		Aluminium is above carbon in the reactivity series so cannot be obtained by reaction of oxide with carbon (1) Copper is below carbon in the reactivity series (1)	2	1.1	
	(b)	(i)	$Al^{3+} + 3e^- \rightarrow Al$ (1)	1	1.1	**ALLOW** any correct multiple **ALLOW** = instead of → **DO NOT ALLOW** & or and instead of +
		(ii)	Ions cannot move (1)	1	1.1	**IGNORE** electrons cannot move
	(c)		Anode: bubbles/effervescence (1) Cathode: Brown/salmon pink deposit/layer/coating (1)	2	1.2	Both correct descriptions but at wrong electrodes

Question			Answer	Marks	AO element	Guidance
26	(a)		…**4**…Fe(s) + …**6**…H_2O(l) +…**3**…O_2(g) → …**2**…Fe_2O_3•$3H_2O$(s)	**2**	**2.1**	**ALLOW** $2Fe(s) + 3H_2O + 1½ O_2(g) \rightarrow (1)Fe_2O_3•3H_2O(s)$
	(b)		Moles of iron = 1000.0 / 55.8 = 17.92 mol (1) Mole ratio (rust / iron) = 2/4 (1) Moles of rust = 17.92 x 2/4 = 8.96 mol (1) Mass of rust = 8.96 x 213.6 = 1914 g (1) Days to rust = 1914 / 60 days (1) = 32 days (1)	**6**	**5 x 2.1** **1.2**	% of iron in rust = ((2 x 55.8) / 213.6) x 100 = 52.25% For a 1.0 kg Fe bar, total mass of rust produced = (1.0 (kg) / 52.25%) x 100% = 1.914 kg = 1914 g

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 22(c) (ii) Mark Scheme correction from 132 to 132.1 (g or tonnes) making final answer 198.2 tonnes of ammonium sulfate Question 23(a) There has been a change to the Mark Scheme: allow alternative calculation method: ((900 000 – 750 000) ÷ 750 000) × 100 (1) Question 26(a) There has been a change to the Mark Scheme. Addition to guidance column: Allow: $2\ Fe(s) + 3H_2O + 1½\ O_2(g) \longrightarrow (1)Fe_2O_3•3H_2O(s)$