OCR
Oxford Cambridge and RSA

Foundation

GCSE

Chemistry A (Gateway Science)

J248/01: Paper 1 (Foundation tier)

General Certificate of Secondary Education

Mark Scheme for June 2022

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: RM 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 available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

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 RM Assessor 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 RM Assessor 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 RM Assessor **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 RM Assessor 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 question on this paper is **20.**

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
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

13. **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.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

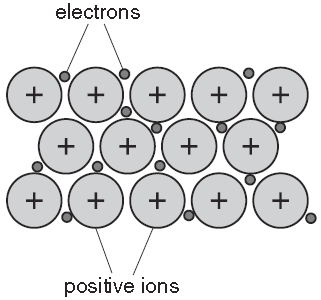
Question	Answer	Marks	AO element	Guidance
1	C ✓	1	1.1	
2	B ✓	1	1.1	
3	B ✓	1	1.1	
4	D ✓	1	1.1	
5	D ✓	1	1.2	
6	B ✓	1	1.2	
7	C ✓	1	2.1	
8	C ✓	1	2.1	
9	B ✓	1	2.2	
10	A ✓	1	1.1	
11	C ✓	1	2.1	
12	A ✓	1	1.1	
13	C ✓	1	1.1	
14	C ✓	1	2.1	
15	A ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
16	(a)		An atom has a nucleus with a **positive** ✓charge. The nucleus is made up of **protons** ✓ and **neutrons**. ✓	3	3 x 1.1	**ALLOW** protons and neutrons in either order
	(b)	(i)	Boron has 11 protons. ☐ The atomic number of boron is 5 ✓ ✓ The electrons are heavier than the protons. ☐ The isotopes of boron have different numbers of neutrons. ✓ ✓ The isotopes of boron have different numbers of protons. ☐ The mass number of boron is the same for both isotopes. ☐	2	2 x 2.1	
		(ii)	(Boron) has three electrons in its outer shell ✓	1	2.1	
	(c)		(Non-metals) gain electrons ✓ forms a (more stable) filled outer shell ✓	2	2 x 1.1	**Ignore** need electrons
	(d)		Al^{3+} ✓	1	2.1	**ALLOW** Al^{+3}

Question			Answer	Marks	AO element	Guidance
17	(a)		Water ✓	1	1.1	**ALLOW** H_2O
	(b)	(i)	Magnesium chloride ✓	1	2.1	**ALLOW** $MgCl_2$ **DO NOT ALLOW** Magnesium chlorine
		(ii)	Idea that the mass stops changing or decreasing / there are no more bubbles (of carbon dioxide gas) formed ✓	1	1.2	**ALLOW** mass stays constant **IGNORE** magnesium carbonate dissolves
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 8.9 (g) award 2 marks** (mass at start of reaction – mass at 8 minutes) = 154.2 – 145.3 ✓ = 8.9 (g) ✓	2	2 x 2.2	**ALLOW** ECF for incorrect masses used in a subtraction of two numbers from the table

Question			Answer	Marks	AO element	Guidance
17	(c)	(i)	Crystallise the filtrate in a crystallising dish. 3 ✓ Distil the filtrate using fractional distillation. Filter the solution, leaving the magnesium carbonate in the filter paper. 2 ✓ Filter the solution, leaving the salt in the filter paper. React hydrochloric acid with excess magnesium carbonate. 1 ✓ React magnesium carbonate with excess hydrochloric acid.	3	3 x 2.2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 22.1 (g) award 3 marks** (20.95 + 22.36 + 21.78 + 23.40) ÷ 4 ✓ = 22.1225 ✓ = 22.1 (3 significant figures) ✓	3	3 x 2.1	**ALLOW** ECF for sig fig mark

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	Ionic compounds have high melting and/or boiling points ✓ Ionic compounds can conduct (electricity) when molten or dissolved, but not as a solid ✓	2	2 x 3.1b	 **ALLOW** only conducts (electricity) when liquid or dissolved **ALLOW** soluble <u>in water</u>
		(ii)	B ✓ (B) has a low melting point / a low boiling point ✓ (B) cannot conduct electricity ✓	3	3 x 3.2b	 **IGNORE** insoluble in water **ALLOW** D and cannot conduct electricity
		(iii)	Gas ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	Positive (metal) ions ✓ Idea of the ions being surrounded by a sea of electrons ✓ Idea that there are strong forces of attraction between ions and electrons ✓	3	1.1	**Any reference to ionic or covalent bonding or IMF scores 0** **ALLOW** a labelled diagram  In a diagram there must be at least one electron in the body of the ions Diagram must show **close packed** metal ions, in a regular arrangement **ALLOW** - / e / e^- / dots for electrons labelled If e or e^- are used they do not need labelling but just a dot or – unlabelled does not score **ALLOW** circles with + or circles labelled positive ions **IGNORE** free electrons If M1 **and** M2 scored allow strong (metallic) bond for M3
		(ii)	Idea that layers or rows or sheets (of particles) slide over each other ✓	1	1.1	**IGNORE** layers can bend **IGNORE** IMF

Question			Answer	Marks	AO element	Guidance
		(iii)	Has electrons ✓ (Electrons) that can move (through the metal) ✓ **OR** Delocalised electrons scores ✓ ✓	2	2 x 1.1	**DO NOT ALLOW** free ions – scores 0 **IGNORE** free (electrons) for idea of movement **IGNORE** carry charge
		(iv)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3:2 award 2 marks** (Lead:tin ratio in diagram =) 12:8 ✓ Divide by 4 to give smallest ratio = 3:2 ✓	2	2 x 2.1	**ALLOW** tin:lead in diagram = 8:12
		(v)	As the silver content increases, the melting point decreases **ORA** ✓	1	3.1a	both variables must be comparative

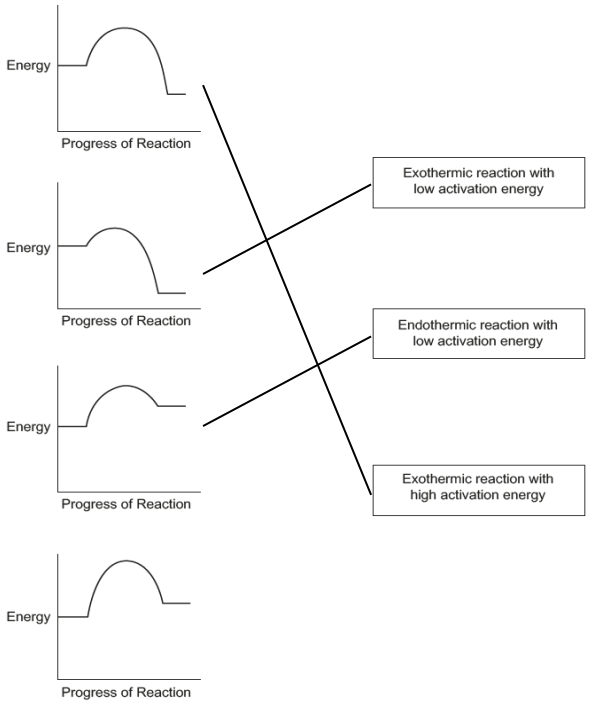
Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Less than 1 nm ☐ Between 1 and 100 nm ☑ ✓ Between 100 and 1000 nm ☐ Greater than 1000 nm. ☐	1	1.1	
		(ii)	**Advantage** Idea that nanoparticulate materials have different properties to the same substance in bulk ✓ **Disadvantage** **Any one from:** Idea that nanoparticles haven't been tested for long-term effects / idea that the risks of nanoparticles aren't yet fully understood Nanoparticles may be breathed in or absorbed by the skin or pass into cells Idea that nanoparticles may take a long time to break down once released into the environment ✓	2	2 x 1.1	**ALLOW** specific properties of nanoparticles e.g. particles can be white in bulk but transparent when nanoparticulate or nanoparticles have a very large surface area to volume ratio or different properties to the bulk material or delivery of drugs / removes smell from clothing / catalysts / antimicrobial / strength to materials / sunscreen **ALLOW** idea that not much research into the **effects** of them

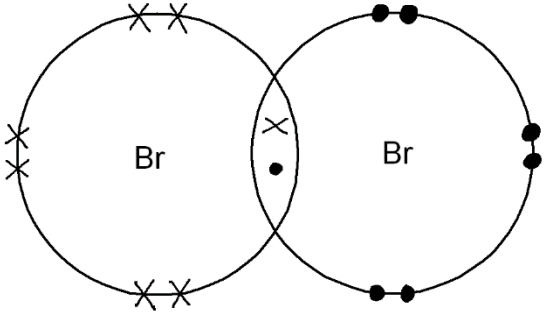
Question			Answer	Marks	AO element	Guidance
	(b)		Stationary phase ✓ Pencil line ✓ Mobile phase ✓	**3**	**3 x 1.2**	

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.85 award 2 marks** R_f = 55 ÷ 65 = 0.846153… ✓ = 0.85 (2 significant figures) ✓	**2**	**2 x 2.2**	**ALLOW** R_f = <u>distance moved by dye</u> distance moved by solvent **ALLOW** ECF for sig fig mark
		(ii)	The Rf values are different ✓ Idea that if dye X was tartrazine, it would have the same R_f value ✓	**2**	**2 x 3.2b**	**ALLOW** R_f tartrazine value is too low / R_f value for tartrazine would be higher / R_f dye X value is too high / R_f value for dye X would be lower R_f dye X is double/ R_f for tartrazine is half / the substances travel different distances

Question			Answer	Marks	AO element	Guidance
20	(a)*		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)** Analyses the information to correctly identify the reaction type in BOTH reaction A AND reaction B **AND** Uses knowledge and understanding to explain why reaction A is exothermic AND reaction B is endothermic 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)** Analyses the information to correctly identify the reaction type in BOTH reaction A AND reaction B **OR** Uses knowledge and understanding to explain why reaction A is exothermic AND reaction B is endothermic **OR** Analyses the information to correctly identify the reaction type in EITHER reaction A OR reaction B **AND** uses knowledge and understanding to explain why reaction A is exothermic OR reaction B is endothermic 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)** Analyses the information to correctly identify the reaction type in EITHER reaction A OR reaction B **OR**	**6**	**2 x 1.1** **4 x 3.2b**	**AO1.1 Demonstrates knowledge and understanding of exothermic and endothermic reactions** • Exothermic reactions increase the temperature (of the surroundings) • Endothermic reactions decrease the temperature (of the surroundings) • In exothermic reactions energy is given out / exothermic reactions have a negative energy change • In endothermic reactions energy is taken in / endothermic reactions have a positive energy change • In exothermic reactions, the energy of the products is lower than the energy of the reactants • In endothermic reactions, the energy of the products is higher than the energy of the reactants **AO3.2b Analyses information and ideas to draw conclusions** • Reaction A has a temperature increase • Reaction A has a temperature change of + 6.6°C • Reaction A has a negative energy change • Reaction A is exothermic • Reaction B has a temperature decrease • Reaction B has a temperature change of - 5.1°C

Question			Answer	Marks	AO element	Guidance
			Uses knowledge and understanding to explain why reaction A is exothermic OR reaction B is endothermic **OR** Correctly calculates the temperature change of reaction A or reaction B 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.			• Reaction B has a positive energy change • Reaction B is endothermic
20	**(b)**	**(i)**	Thermometer ✓	**1**	**1.2**	**ALLOW** temperature probe
		(ii)	**Any two from:** Put a lid on the beaker ✓ Use a polystyrene cup / idea of using a container made from a material that is a better insulator than glass ✓ Idea of wrapping insulating material around the beaker ✓	**2**	**2 x 3.3b**	**IGNORE** tin/aluminium foil

Question			Answer	Marks	AO element	Guidance
20	(c)			3	3 x 1.1	

Question			Answer	Marks	AO element	Guidance
21	(a)		The model shows how many electrons the carbon atoms have. ☐ The model shows how many electrons the hydrogen atoms have. ☐ The model shows how much space each atom fills. ☐ The model shows that the carbon atoms are bigger than the hydrogen atoms. ☑ ✓ The model shows the difference between double bonds and single bonds. ☑ ✓	2	2 x 2.1	
	(b)		 Shared pair of electrons ✓ Rest of structure correct ✓	2	2 x 1.2	**ALLOW** electrons as all dots, all crosses, or a mix of dots and crosses **ALLOW** diagrams with inner electron shell, but inner shells must be correct if shown **Second marking point is dependent on one shared pair of electrons**

Question			Answer	Marks	AO element	Guidance
21	(c)		**Any two from:** Particles are closer together in bromine / further apart in ethene ✓ Particles move faster in ethene / move slower in bromine ✓ Particles have more energy in ethene / less energy in bromine ✓ Particles are arranged more randomly in ethene / less randomly in bromine ✓ Forces between particles are stronger in bromine / weaker in ethene ✓	2	2 x 2.1	**Answer must be comparative** **ALLOW** gas for ethene and liquid for bromine **ALLOW** 1 mark for 2 correct ideas without explicit reference to particles
	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2 award 3 marks** (2 x 12.0 = 24 and 4 x 1.0 = 4.0) ✓ **OR** 24.0 + 4.0 = 28.0 ✓ 187.8 – 28.0 = 159.8 ✓ 159.8 ÷ 79.9 = 2 ✓	3	3 x 2.1	**ALLOW** (2 x 12 = 24 and 4 x 1 = 4) ✓ **OR** **ALLOW** 24 + 4 = 28 ✓ **ALLOW** ECF from MP1 **ALLOW** ECF from MP2

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	(Paper / gas / thin layer) chromatography	1	2.2	**ALLOW** test or measure melting point / test or measure boiling point
		(ii)	C_3H_7	1	2.1	**ALLOW** H_7C_3 **DO NOT ALLOW** C3H7 or C^3H^7 or $(C_3H_7)_2$
		(iii)	**Any four from:** (Simple) distillation ✓ **BUT** fractional distillation ✓✓ Use of a condenser ✓ Description of liquid (hexane) <u>boiling</u> (to gas) and then condensing (back to liquid) Idea of heating the mixture to or higher than the boiling point of hexane ✓ Idea that (hexane will boil at a lower temperature than cyclohexane, so) hexane will be collected first ✓	4	4 x 3.3a	Marks can be awarded from a labelled diagram **ALLOW 1 mark** for a fractionating column when used with a condenser for idea of fractional distillation **IGNORE** condensing tube **IGNORE** idea of hexane evaporating **ALLOW** hexane will boil first
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer =** 79 (%) **award 2 marks** $\frac{12.0}{15.2} \times 100 = 78.947$ ✓ 79 (%) (2 significant figures) ✓	2	2 x 2.2	 **ALLOW** ECF for sig fig mark
		(ii)	$2C_6H_{14}$ + **19** $O_2 \rightarrow$ **12** CO_2 + **14** H_2O ✓	1	2.1	**ALLOW** correct multiples

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