GCE

Chemistry B

H033/01: Foundations of chemistry

AS Level

Mark Scheme for June 2024

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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.

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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.

There are no level of response questions in this paper.

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.

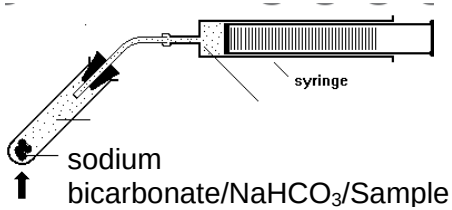
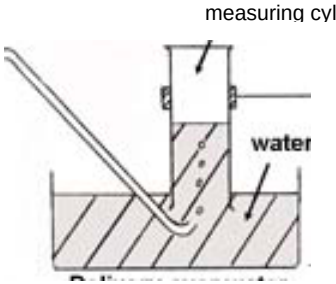
You should ensure that you have copies of these materials.

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.

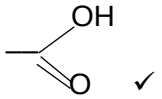
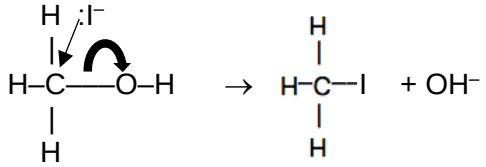
Section A answers

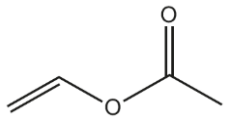
No.	Key
1	C
2	B
3	B
4	C
5	C
6	A
7	A
8	C
9	A
10	C
11	A
12	D
13	B
14	B
15	B
16	B
17	D
18	C
19	C
20	D

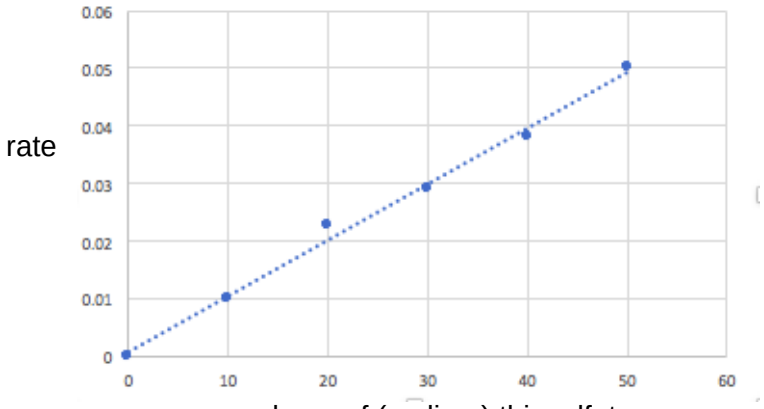
Question			Answer	Marks	Guidance
21	a		sodium hydrogen carbonate	1	**ALLOW** no gap between 'hydrogen' and 'carbonate' **DO NOT ALLOW** use of oxidation numbers
	b	i	 test-tube labelled as above, connected without leaks ✓ to either a gas syringe or a measuring cylinder/inverted burette over water ✓	2	**ALLOW** alternative vessels for heating for MP1 Tube can be horizontal but heat must be applied to solid **ALLOW** diagrams where tube does not go through the bung  to score MP2: the measuring cylinder/burette must be labelled as such or have calibration marks shown.
		ii	**FIRST CHECK ANSWER ON ANSWER LINE** **If volume = 14 cm^3 award 2 marks** amt bicarb = 0.1/84 (= 1.19×10^{-3} mol) **AND** divide by two to get moles of CO_2 (5.95×10^{-4}) ✓ vol $CO_2 = 5.95 \times 10^{-4} \times 24000 = 14\ cm^3$ ✓	2	**ALLOW** two or more sf that rounds to 14 Final answer rounding to 29 scores 1 mark **ALLOW** ecf **ALLOW** correct use of ideal gas equation
	c	i	**FIRST CHECK ANSWER ON ANSWER LINE** **If ΔH = –35 (kJ mol^{-1}) award 3 marks** ('heat' given out) = 27 x 4.18 x 5.80 J (= 654.6) ✓ (amount Na_2CO_3) = 2.0/106 (= 1.89×10^{-2}) ✓ ΔH = (0.6546/ 1.89×10^{-2}) = –35 kJ mol^{-1} ✓	3	**ALLOW** two or more sf that rounds to -34 or -35 **ALLOW** correct evaluation for MP1 and MP2 **ALLOW** ecf for MP3 Negative sign necessary for MP3

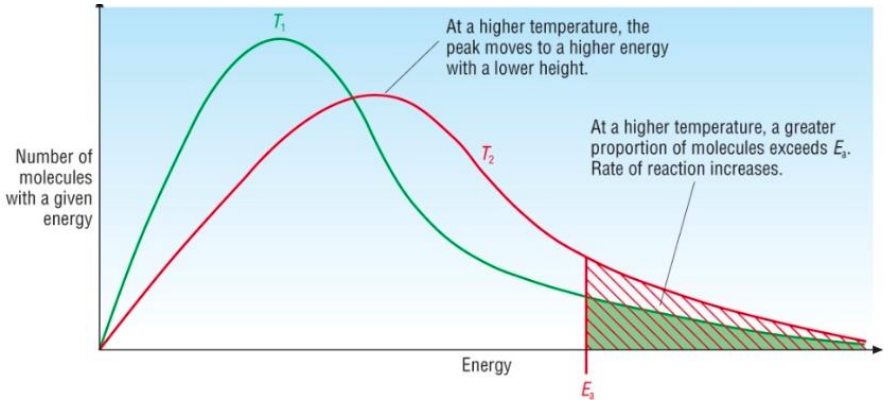
Question			Answer	Marks	Guidance
21	c	ii	2.5 %	1	
		iii	Use polystyrene cup ✓ (greater) insulation ✓	2	**ALLOW** 'thermos flask'(AW), plastic cup, styrofoam **IGNORE** added equipment **ALLOW** insulated container
		iv	**FIRST CHECK ANSWER ON ANSWER LINE** **If ΔH = (+) 57 award 2 marks** $\Delta H = \Delta H_2 - \Delta H_1$ ✓ = (+) 57 (kJ mol^{-1}) ✓	2	**ALLOW** more decimal places to match (c)(i) **ALLOW** ecf from (c)(i) MP1 $\Delta H = \Delta H_2 - \Delta H_1$ (or '22 – answer from (c)(i)) MP2 Evaluation of '22 – answer from (c)(i)' (including sign if negative) Evaluation of numbers that do not correspond to $\Delta H = \Delta H_2 - \Delta H_1$ does not score MP2
				13	

Question			Answer	Marks	Guidance
22	a		appearance: dark lines on a continuous (visible) spectrum ✓ electrons are excited/ move up to higher energy levels/shells ✓ absorb energy of (definite) frequency / (Δ)E = hν ✓ energy/absorption shows as a line in the spectrum ✓ emission spectra lines in the same place/ at the same frequencies/wavelengths ✓	5	**ALLOW** dark/black lines on a coloured/rainbow background for MP1 **DO NOT ALLOW** MP2 if mention of 'dropping down' (AW) **ALLOW** 'wavelength' instead of 'frequency' **ALLOW** 'absorbs photon'/ ΔE = hf **ALLOW** lines get closer together as frequency increases
	b		Spherical/sphere ✓	1	
	c	i	(Is^2) $2s^2 2p^6 3s^2 3p^6 4s^2$ ✓	1	**ALLOW** capital letters but not subscripts
		ii	Same electron configuration/ s^2 /same number/2 electrons **AND** in outer (sub) shell. ✓	1	**ALLOW** 2/same number of valence/outer electrons **ALLOW** outer orbital / outer energy level
		iii	**A** is gallium/ Ga ✓ Any three from: ✓✓✓ Group 3 (or TM) **OR** 3+ or +3 oxidation state Not TM (AW) since low mpt Period 4 (or below) since d electrons **OR** contains 3d electrons Oxide has M_r of 187.4	4	**ALLOW** 3 outer shell electrons **ALLOW** past Calcium **ALLOW** A_r less than 76 **DO NOT ALLOW** incorrect M_r **ALLOW** ecf for M_r if incorrect element as long as below 200
				12	

Question			Answer	Marks	Guidance
23	a	i	 ✓	1	**DO NOT ALLOW** if bond shown between O and H **IGNORE** other structures as 'working'
		ii	iodomethane ✓	1	**DO NOT ALLOW** iodo-methane, 1-iodomethane **ALLOW** iodo methane
	b		100%✓	1	
	c		**FIRST CHECK ANSWER ON ANSWER LINE** **If mass = 7.0(g) award 3 marks** (amount ethanoic acid) = 15/60 (= 0.25 mol) ✓ (mass CO) = 0.25 x 28 = 7 ✓ 7.0 (g) (2 sf) ✓	3	 **ALLOW** ecf from incorrect M_r **ALLOW** any calculated answer to 2sf for this mark
	d	i	(a molecule or negatively charged ion) that can donate (**AW**) a (lone) pair of electrons to form a covalent bond✓	1	**ALLOW** has pair of electrons that forms dative bond
		ii	 curly arrows ✓ products ✓	2	first curly arrow should start on lone pair (or negative charge) on iodide and point towards C atom (or the bond formed). **IGNORE** further reaction with H^+ **IGNORE** omission of + sign between products **IGNORE** partial charges

23	**e**	**i**	d (block) ✓	**1**	**DO NOT ALLOW** 'D'
		ii	less by-product (ora) ✓	**1**	**ALLOW** "less side products" **IGNORE** less waste (products) **DO NOT ALLOW** comparisons of atom economy
	f		 correct monomer (even if not skeletal) ✓ correct skeletal formula ✓	**2**	**IGNORE** other structures as 'working' if correct structure is given
				13	

Question			Answer	Marks	Guidance
24	a	i	0.029 ✓	1	
		ii	 labelled axes (ignore units) with vol of thiosulfate as x-axis and scales chosen to fill at least half of grid available ✓ points plotted correctly (look at 'shape' of points relative to straight line) ✓ Best fit straight line going through origin and within 2 small squares of all points except (20,0.023) ✓	3	Plotted point not needed at 0,0 for MP2 ecf from 24 (a) (i) Can score MP2 and MP3 if rate on x axis and volume on y axis
		iii	the total volume is constant each time ✓	1	**IGNORE** volume stated
		iv	Rate ∝ concentration ✓ Number/frequency/chance (AW) of (successful) collisions increases with concentration ✓	2	**ALLOW** directly proportional **ALLOW** doubling concentration, doubles number/frequency/chance of (successful) collisions (AW) **ALLOW** Number/frequency/chance (AW) of (successful) collisions increases with volume (of thiosulphate)

24	**b**		 Diagram as above with second line (peak below first line) ✓ Areas shown as 'number/proportion of collisions/ molecules with energy > Ea / sufficient energy to react ✓	**2**	For MP1, the higher temperature line must start at origin, not touch x axis or cross other line after Ea nor must it curve upwards. For MP2 must be an indication of area under the curve, not just a point on the curve
	c	**i**	$S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow H_2O(l) + SO_2(g) + S(s)$ +2 ✓ +4 and 0 ✓	**2**	**ALLOW** 1 mark for all correct but with + signs missing or sign after number
		ii	S/ sulfur is both oxidised and reduced. ✓	**1**	**ALLOW** Thiosulfate/$S_2O_3^{2-}$ both oxidised and reduced
				12	

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