GCE

Chemistry B

H033/01: Foundations of chemistry

AS Level

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. 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

11. 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

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.

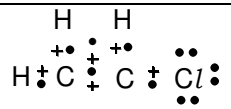
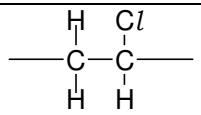
You should ensure that you have copies of these materials.

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.

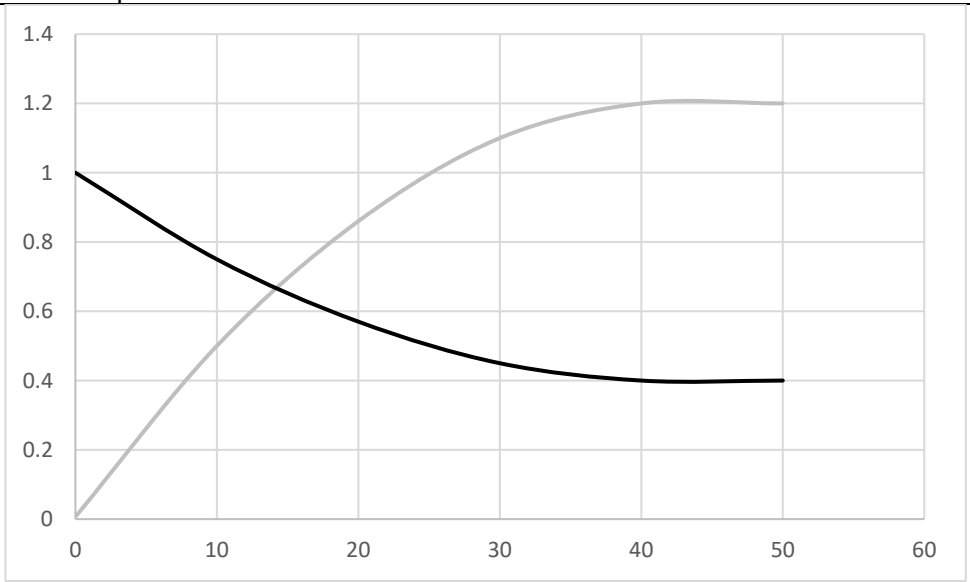
Section A answers

No.	AO	Key
1	2.1	C
2	1.1	A
3	1.1	D
4	1.2	B
5	1.2	A
6	1.1	D
7	1.1	C
8	2.5	C
9	1.1	A
10	2.5	A
11	1.1	A
12	1.2	B
13	2.8	A
14	2.3	D
15	1.2	B
16	2.2	B
17	2.1	B
18	2.1	C
19	2.2	C
20	1.1	B

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	ethene ✓ chloroethene ✓	2	1.2 x 2	**ALLOW** 'chloro-ethene' and '1-chloroethene'
		(ii)	 double bond ✓ rest ✓	2	2.1 x 2	**ALLOW** two dots and two crosses in any sequence and orientation for double bond If a variety of symbols are used they must be consistent for an atom.
		(iii)	chlorine/ Cl_2 ✓	1	1.1	**DO NOT ALLOW** 'chlorine water'
		(iv)	 ✓	1	1.1	**IGNORE** brackets and 'n' **ALLOW** any unambiguous structure eg $–CH_2CHCl–$
	(b)		carbocation CH_3CH^+Cl is more stable ✓ attack by $Br^{(\delta)-}$ / electrophile to give $CH_3CHBrCl$ ✓	2	3.1 3.2	
	(c)		*instantaneous dipole-induced dipole:* electrons (in molecules/bonds are in motion and) are not always evenly distributed (AW) (which causes an instantaneous/temporary dipole) ✓ (this) induces a dipole in another molecule (and attracts it) ✓ *permanent dipole-permanent dipole:* C–C*l*/vinyl chloride has a permanent dipole since C*l* more electronegative than C ✓ the permanent dipoles attract/form a bond ✓ vinyl chloride higher bpt since pd-pd stronger/ more energy needed to break/ harder to break **ORA** ✓	5	1.1 1.1 1.1 1.1 2.1	**ALLOW** abbreviations 'id' and 'pd' **DO NOT ALLOW** 'atom' for 'molecule' (or vice-versa) the first time it is mentioned, but **IGNORE** thereafter **ALLOW** for a 'general' molecule: (two atoms) with different electronegativity cause permanent dipole(AW)✓ the permanent dipoles attract/ form a bond ✓ must be comparison eg 'stronger' (allow 'strongest') **IGNORE** references to molecular size/mass **ALLOW** references to melting point rather than boiling point
			Total	13		

Question			Answer	Marks	AO element	Guidance
22	a	i	*two from:* ✓✓ damages plants/ habitats damages rubber respiratory/eye problems (AW) (photochemical) smog	2	1.1 x 2	
		ii	1 x 10^{-6} (%) = 0.01 ppm/ 0.07(ppm) = 7 x 10^{-6} % **and** not dangerous ✓	1	3.1	Final unit must be given.
	b		*one from:* ✓ skin cancer/ sunburn or damages skin damages DNA/ causes mutations damages eyes	1	1.1	
	c	i	$ClO + O \rightarrow Cl + O_2$ **OR** $ClO + O_3 \rightarrow Cl + 2O_2$ ✓	1	1.2	**IGNORE** dots on radical species **DO NOT ALLOW** charges
		ii	$Cl + Cl \rightarrow Cl_2$ **OR** $ClO + ClO \rightarrow Cl_2 + O_2$ ✓	1	1.1	**IGNORE** dots on radical species **DO NOT ALLOW** charges
	d		**CHECK ANSWER LINE** **If answer = 8.67 x 10^{14} (Hz) award 3 marks** 1. v= (Δ)E/h ✓ 2. = 346 x 10^3/ (6.63 x 10^{-34} x 6.02 x 10^{23}) ✓ 3. calculation = 8.67 x 10^{14} (Hz) ✓	3	2.6 x 3	**ALLOW** 2 or more sf. MP 1 can be assumed from subsequent steps MP 3. **ALLOW** ecf from expression with 10^3 **or** N_A missing or a transcription error (eg 343 for 346) I.e. 8.67 x 10^{11} or 5.22 x 10^{38} score 2 marks
	e		22.3 radical ✓ 22.4 nucleophilic substitution ✓ 22.3 homolytic (fission)/ one electron to each atom ✓ 22.4 heterolytic (fission)/ both electrons go to one atom/Cl✓	4	3.1 x 2 1.2 x 2	Mechanisms with curly/ half curly arrows can score these points.
				13		

Question			Answer	Marks	AO element	Guidance
23	a		sodium chlorate(I) ✓	1	1.2	**DO NOT ALLOW** sodium(I) chlorate(I) **ALLOW** gap between chlorate and (I)
	b	i	$2Cl^- \rightarrow Cl_2 + 2e^-$ ✓	1	1.2	**ALLOW** Cl^- --> $\frac{1}{2}Cl_2 + e^-$ **ALLOW** electron with or without minus sign **IGNORE** state symbols in all parts of (b) **ALLOW** electrons removed on the opposite side to electrons added in all parts of (b)
		ii	$2H_2O + 2e^- \rightarrow 2OH^- + H_2$ ✓	1	2.7	**ALLOW** $H_2O + e^- \dashrightarrow OH^- + \frac{1}{2}H_2$ **ALLOW** electron with or without minus sign **ALLOW** multiples
		iii	$Cl_2 + OH^- \rightarrow ClO^- + HCl$ ✓	1	2.5	**ALLOW** $Cl_2 + 2OH^- \rightarrow 2ClO^- + H_2$
	c	i	sulfur/S✓ +2 to +2½ / +2.5 ✓	2	1.2 x 2	**ALLOW** 'sulphur' **DO NOT ALLOW** $S_2O_3^{2-}$ Oxidation states must have + sign
		ii	titrate with thiosulfate in <u>burette</u> ✓ end point – blue colour goes ✓ repeat (AW) ✓	3	3.3 x 3	
		iii	**CHECK ANSWER LINE** **If answer = 48 (g dm^{-3}) award 4 marks** amount thio = 20.30 x 1.6/1000 = 3.25 x 10^{-2} mol ✓ conc ClO^-=0.5 x 3.25 x 10^{-2} x 1000/25 = 0.650 mol dm^{-3} ✓ conc NaClO = 0.650 x 74.5 = 48.4... (any sf) = 48 (2 sf) ✓	4	2.8 x 3 3.1	97 (g dm^{-3}) [omission of 0.5] scores 3 1. Calc of amount thio (can be assumed from subsequent step) 2. Calc of conc ClO^- (including use of 0.5) ecf from 1. 3. Multiplying any number by 74.5 4. Use of 2 sf.(on any calculated number)
		iv	(the answer) would be more reliable/ less uncertain/lower %error **OR** more (or 3) sig figs/ more decimal places possible (this assumes pipette measures volume as 25.0) ✓	1	3.4	**DO NOT ALLOW** answers that say the result would be 'higher' or 'lower' (but **IGNORE** 'higher or lower') **IGNORE** references to 'precision' **ALLOW** 'more accurate' (see OCR document 577372) must imply reference to the answer in (iii), not volume of thio.
				14		

Question			Answer	Marks	AO element	Guidance
24	a		Concentrations constant ✓ Rates equal ✓	2	1.1 x 2	**NOT** 'equal' for concentrations
	b		 Line starting at 1 and finishing at 0.4 at 40 s. ✓ Curve as shown (including a horizontal portion at end) ✓	2	2.8 x 2	Please place tick or cross for first mark where line hits 0.4 second mark on body of curve
	c		**CHECK ANSWER LINE** **If answer = 3.6 award 2 marks** (K_c =)$[NO_2]^2/[N_2O_4]$ ✓ $= (1.2)^2/0.4 = 3.6$ ✓	2	2.4 x 2	No ecf, except for inverted Kc (**ALLOW** 0.28 (any sf) for 1 mark) **IGNORE** units
	d		endothermic (forward) reaction ✓ equilibrium moves to oppose increase in temp/ to right /forward endothermic direction✓	2	2.5 x 2	**ALLOW** $\Delta H = +58$ (kJ mol^{-1})/ ΔH positive
	e		Faster/ rate increases ✓ More (frequent) collisions with energy > Ea ✓	2	2.7 x 2	IGNORE references to equilibrium **ALLOW** 'more (frequent) successful collisions'
				10		

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