Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Chemistry

Assessment Unit AS 2

assessing

Further Physical and Inorganic Chemistry
and an Introduction to Organic Chemistry

[SCH22]

MONDAY 5 JUNE, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

The main purpose of the mark scheme is to ensure that examinations are marked accurately, consistently and fairly. The mark scheme provides examiners with an indication of the nature and range of candidates' responses likely to be worthy of credit. it also sets out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for **GCE Chemistry:**

Candidates should be able to:

AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling quantitative and qualitative data
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence (in relation to particular issues) • make judgements and reach conclusions • develop and refine practical design and procedures

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 17- or 18-year-old which is the age at which the majority of candidates sit their GCE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. The exception to this for GCE Chemistry is when Examiners are marking complex calculations and mechanisms when the Examiners are briefed to mark by error or omission. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 17- or 18-year-old GCE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

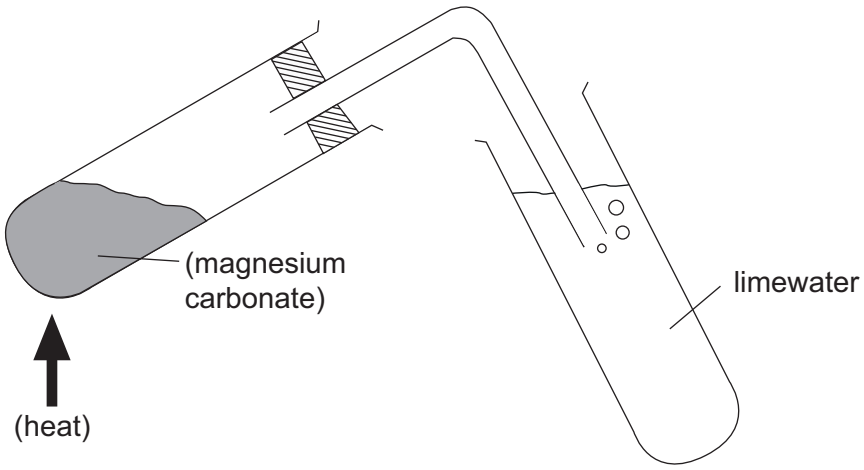
Section A

	AVAILABLE MARKS
1 B	
2 B	
3 A	
4 D	
5 A	
6 C	
7 C	
8 C	
9 D	
10 C	
[1] for each correct answer	10
Section A	**10**

Section B

AVAILABLE MARKS

11 (a) (i)



error [–1]
size of limewater tube can be smaller/larger or any container [2]

(ii) $MgCO_3 \rightarrow MgO + CO_2$ [1]

(iii) Mg^{2+} smaller than Ca^{2+}/higher charge density [1]
Polarises carbonate ion/destabilises carbonate (more than Ca^{2+}) [1] [2]

(b) (i) magnesium hydroxide [1]

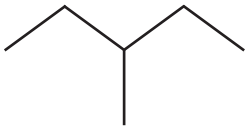
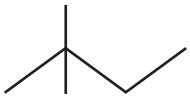
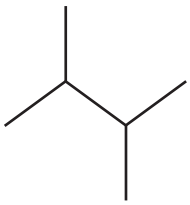
(ii) $Mg^{2+} + 2OH^- \rightarrow Mg(OH)_2$ [1]

(c) (i) barium sulfate [1]

(ii) $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ [2]

(d) (i) (bright) white light [1] white solid [1] [2]

(ii) $2Mg + O_2 \rightarrow 2MgO$ [1] 13

				AVAILABLE MARKS
12	**(a)**	same molecular formula [1] different structural formula [1]	[2]	
	(b)	3-methylpentane 		
		2,2-dimethylbutane 		
		2,3-dimethylbutane 	[3]	
	(c)	More contact between molecules [1] Greater van der Waals' forces [1]	[2]	
	(d)	**(i)** $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$	[2]	
		(ii) $2C_6H_{14} + 13O_2 \rightarrow 12CO + 14H_2O$	[2]	11
13	**(a)**	**(i)** $\left(K_c = \right)\frac{[NH_3]^2}{[N_2][H_2]^3}$ [1] $mol^{-2}\ dm^6$ [1]	[2]	
		(ii) equilibrium lies to left-hand side	[1]	
	(b)	**(i)** Reaction exothermic [1] (When temperature is lowered) the equilibrium shifts to RHS (to oppose change) [1]	[2]	
		(ii) Reaction is too slow	[1]	
		(iii) 4 moles of gas LHS $\rightarrow$ 2 moles gas RHS [1] When pressure increases the equilibrium shifts to RHS (to oppose change) [1]	[2]	
		(iv) Too expensive since thicker pipes are required/more steel	[1]	9

AVAILABLE MARKS

14 **(a)** Same bonds present/C–C, C–H, C–O and O–H [1]
Same absorptions/peaks in same places [1] [2]

(b) **(i)** $(CH_3)_3COH + PCl_5 \rightarrow (CH_3)_3CCl + HCl + POCl_3$ [2]

(ii) 2-chloro-2-methylpropane [1]

(c) **Indicative content**
acidified potassium dichromate(VI)
heat
butan-2-ol: orange to green
secondary alcohols can be oxidised
2-methylpropan-2-ol: remains orange
tertiary alcohols cannot be oxidised

Band	Response	Mark
A	Candidates must use appropriate specialist terms using a minimum of 5 points of indicative content. They must use good spelling, punctuation and grammar and the form and style are of an excellent standard.	[5]–[6]
B	Candidates must use appropriate specialist terms using a minimum of 3 points of indicative content. They must use satisfactory spelling, punctuation and grammar and the form and style are of a good standard.	[3]–[4]
C	Candidates use a minimum of 2 points of indicative content. They use limited correct spelling, punctuation and grammar and the form and style are of a basic standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

11

			AVAILABLE MARKS
15	**(a)**	Enthalpy change when one mole of water Is formed in a neutralisation reaction [2]	
	(b)	**(i)** measuring cylinder/burette/pipette [1]	
		(ii) Insulates/does not absorb heat [1]	
		(iii) $NaOH + HCl \rightarrow NaCl + H_2O$ (or ionic) [1]	
		(iv) 100 × 4.2 × 13.3 5586 J [2]	
		(v) 2.0 × 0.05 = 0.1 moles NaOH **or** 2.0 × 0.05 = 0.1 moles HCl = 0.1 moles water formed [1] [1]	
		(vi) 5586 ÷ 1000 = 5.586 kJ 5.586 ÷ 0.1 = 55.86 kJ mol^{-1} Exothermic –55.86 kJ mol^{-1} [3]	
		(vii) Some heat lost to the surroundings [1]	12

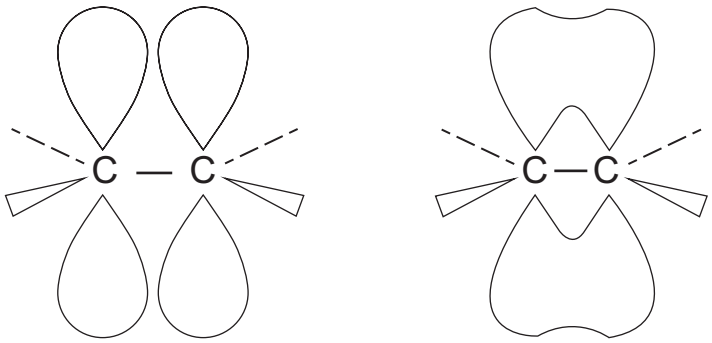
AVAILABLE MARKS

16 (a)

C	H
85.7	14.3
7.14 moles	14.3 moles
1	2 (.014)

Empirical formula = CH_2 [2]

(b) (i)



[1]

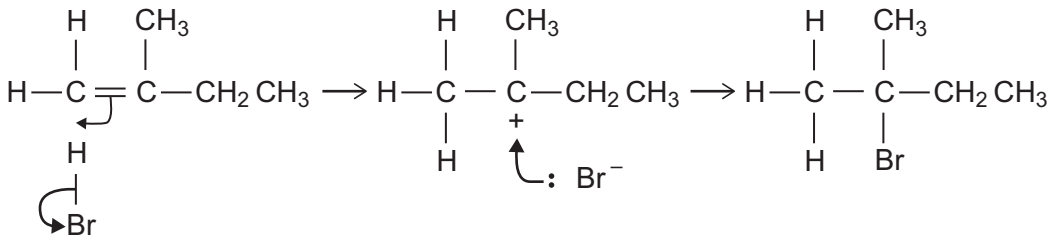
(ii) Pi bond is a weaker bond than sigma
Electron rich/high electron density
Prone to attack by electrophiles
Any 2 from 3 [2]

(c) (i) δ+ δ–
H–Br [1]

(ii) Electrophilic [1] addition [1] [2]

(iii) 2-bromo-2-methylbutane [1]

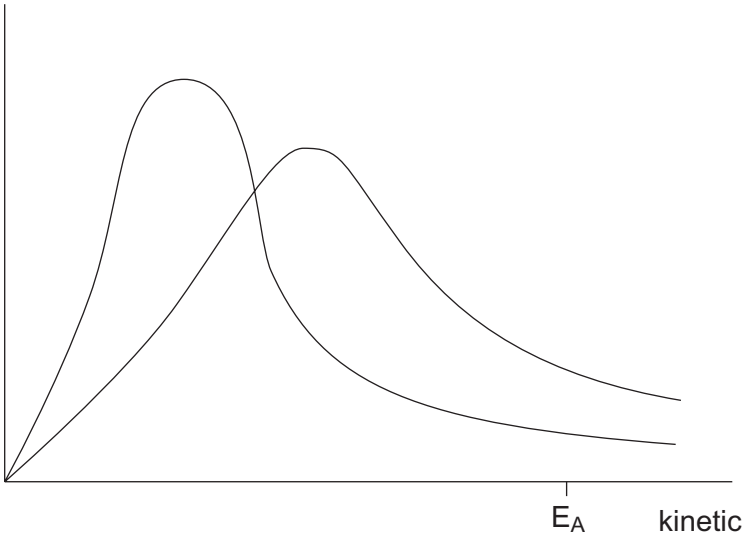
(iv)



[3] is for mechanism
[1] is for correct use of curly arrows [4]

(v) Tertiary carbocation/carbonium ion [1]
More stable than primary carbocation [1] [2]

15

			AVAILABLE MARKS
17	**(a)**	An ion or molecule, with a lone pair of electrons, that attacks regions of low electron density. [2]	
	(b)	**(i)** activation energy (E_A) at a high energy value on the x-axis [1]	
		(ii) number of ions 	
		Starts at origin Peak higher to the left Curve below original at high kinetic energy values (error [–1]) [2]	
		(iii) rate decreases [1] fewer hydroxide ions with energy greater than activation [1] [2]	
	(c)	faster [1] C–I bond weaker than C–Br bond [1] [2]	9
		Section B	**80**
		Total	**90**