New Specification

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2018

Chemistry

Assessment Unit AS 2

assessing

Further Physical and Inorganic Chemistry
and an Introduction to Organic Chemistry

[SCH22]

FRIDAY 25 MAY, MORNING

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

Section B

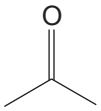
AVAILABLE MARKS

11 **(a)** propan-2-ol/2-hydroxypropane [1]

(b) **(i)** molecules which have the same molecular formula [1]
but a different structural formula [1] [2]

(ii) **Between** molecules of ethyl methyl ether there are permanent dipole and/or van der Waals' forces [1]
Between molecules of isopropyl alcohol there are H–bonds and (van der Waals' forces) [1]
H–bonds are stronger/require more energy to break [1] [3]

(c) **(i)**



structure [1] [1]

(ii) ketone [1]

(iii) disappearance of absorption peak at 3200–3600 cm^{-1} [1]

(d) $\frac{1.0}{60} = 0.025$
moles of propanone = 0.025
expected mass of propanone = 0.025 × 58 = 1.45g
% yield = $\frac{1.0}{1.45} \times 100 = 68.97\%$ ([–1] each error) [3]

(e) **(i)** Isopropyl alcohol contains an OH group [1]
and can form H-bonds with water molecules [1] [2]

(ii) increased competition for bonding with water molecules
or
water molecules form stronger bonds with Na^+/Cl^- ions [1] 15

12 **(a)** $Ca_3(PO_4)_2$ [1]

(b) **(i)** $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ [2]

(ii) fewer moles of strontium/strontium has a higher RAM. [1]

(iii) reaction faster/more vigorous [1] as strontium is more reactive [1]
or
product mixture is less cloudy [1] as strontium hydroxide is more soluble [1] [2]

(c) **(i)** thermal decomposition (breakdown using) heat [1]

(ii) thermal stability increases as Group is descended. [1]
Cation radius increases. [1] Therefore polarising ability decreases.[1] [3]

(d) It is a base [1]

(e) **(i)** Effervescence [1]
(white) solid appears/rock disappears [1] [2]

(ii) magnesium sulfate is more soluble than calcium sulfate [1]

(iii) 59.2 – 35.1 = 24.1 g in 100 g of water
24100 kg in 100 tonnes of water
24.1 tonnes [2]

(f) mass of H_2O = 2.50 – 1.22 = 1.28 g

Moles of H_2O = $\frac{1.28}{18}$ = 0.07(11)

Moles of $MgSO_4$ = $\frac{1.22}{120}$ = 0.0102

$MgSO_4$: H_2O

0.01 : 0.07

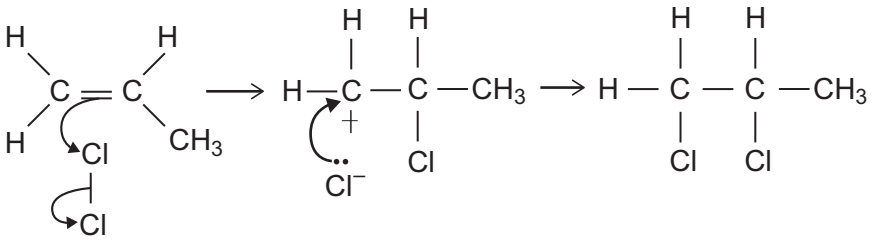
1 : 7

$MgSO_4.7\ H_2O$

([–1] each error) [3] 19

13 **(a)** **(i)** An ion or molecule [1]
that attacks regions of high electron density [1] [2]

(ii)



[4]

(b) initiation: $Cl_2 \rightarrow 2Cl^{\bullet}$

propagation: $CH_2CHCH_3 + Cl^{\bullet} \rightarrow CH_2CHCH_2^{\bullet} + HCl$

$CH_2CHCH_2^{\bullet} + Cl_2 \rightarrow CH_2CHCH_2Cl + Cl^{\bullet}$

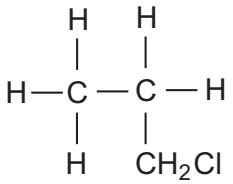
termination: $Cl^{\bullet} + Cl^{\bullet} \rightarrow Cl_2$

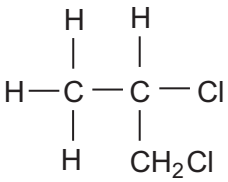
$CH_2CHCH_2^{\bullet} + CH_2CHCH_2^{\bullet} \rightarrow CH_2CHCH_2CH_2CHCH_2$

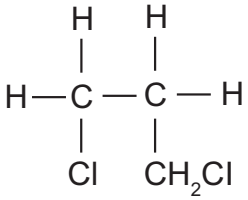
$CH_2CHCH_2^{\bullet} + Cl^{\bullet} \rightarrow CH_2CHCH_2Cl$ [4]

AVAILABLE MARKS

(c) **(i)**

Compound A 

Compound B 

Compound C 

[3]

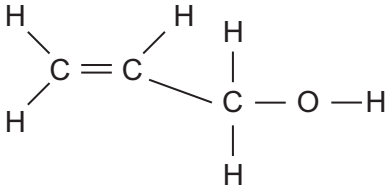
(ii) The intermediate/carbocation formed in the formation of compound B is a sec carbocation. This is more stable (error (−1)) [2]

(iii)

C	:	H	:	O
40	:	7	:	53
12	:	1	:	16
3.33	:	7.0	:	3.31
1	:	2	:	1

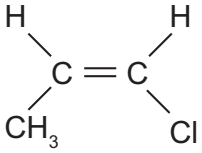
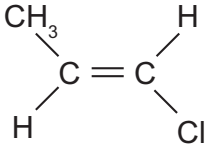
Empirical formula = CH_2O

Molecular Formula = $C_3H_6O_3$ [3]

(d) **(i)** 

[2]

(ii) Sodium chloride [1]

(e)  

[3]

Z E

(f) **(i)** the volume of one mole of gas under specified conditions of temperature and pressure [1]

(ii) 1 mol = 24 dm^3

0.041 mol = 0. 986 dm^3

$M_r = \frac{1.50}{0.0411} = 36.5$

HCl = 1 + 35.5 = 36.5 [3]

28

14 (a) (i) (Reaction to proceed via a route with) lower activation energy [1]
a greater proportion of molecules with energy equal/greater than the activation energy [1] [2]

(ii) Indicative content

- Low temperature
- As temperature decreases equilibrium moves in exothermic direction
- High pressure
- As pressure increases equilibrium moves towards the side with smaller number of gas moles
- Low temperature means rate is slow so compromise temperature of (300°C) used
- High pressure is expensive therefore compromise of (6000kPa) used

Band	Response	Mark
A	Candidates must use appropriate specialist terms giving 5–6 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 giving 3–4 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 must use 1–2 points of indicative content. They use limited correct spelling, punctuation and grammar and the form and style is of a basic standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

(b) (i) $2C(s) + 3H_2(g) + 1/2\ O_2(g) \rightarrow C_2H_5OH(l)$ [2]

(ii) (If these elements were reacted together) other products would form/carbon does not react with hydrogen/oxygen under standard conditions [1]

(iii) $-189.7 + (-45.0) = \Delta H_r$
$-234.7\ kJ\ mol^{-1} = \Delta H_r$
([–1] each error) [3]

(c) (i) $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ [2]

(ii) Energy produced during bond making in products is greater [1] than energy needed to break bonds in the reactants [1] [2]

AVAILABLE MARKS
18
Section B **80**
Total **90**