Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC122]

MONDAY 15 JUNE, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finished.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published; the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

Section A

	AVAILABLE MARKS
1 C	
2 B	
3 D	
4 D	
5 B	
6 A	
7 D	
8 A	
9 C	
10 D	
[2] for each correct answer [20]	20
Section A	**20**

Section B

AVAILABLE MARKS

11 (a) $CH_3\bullet$ $C_2H_5\bullet$ $H\bullet$ [2]

(b)

Initiation	P	
Propagation	Q	
	R	
	S	
Termination	T	
	U	error [–1]

[3] 5

12 (a) (i) $CH_3CH_2CH_2CH_2CH{=}CH_2$ [1]

(ii) CCl_3CH_3 [1]

(iii) $CH_3CH_2CH_2CH_2CH{=}CH_2 + Br_2 \rightarrow CH_3CH_2CH_2CH_2CHBrCH_2Br$ [2]

(iv) Starting from product [1]
No bromine colour appears [1] [2]
or
Equimolar quantities of reactants/hex-1-ene in excess [1]
Bromine colour disappears completely [1]

(b) (i) the mass of 2 cm^3 of hex-1-ene
= 2 × 0.68 = 1.36 g

the rise in temperature
= 32.1 – 24.9 = 7.2°C

the mass of 100 cm^3 of TCE
= 100 × 1.33 g = 133 g

the heat energy received by the 100 cm^3 of TCE
= 133 × 1.30 × 7.2 = 1245 J

the molar mass of hex-1-ene
= 6 × 12 + (12 × 1) = 72 + 12 = 84 g

the number of moles of hex-1-ene in 2 cm^3
= 1.36/84 = 0.01619

the molar enthalpy of bromination of hex-1-ene
= 1245/0.016 = –77.8 kJ or $kJ\,mol^{-1}$ [5]
Missing or incorrect units penalise once

(ii) bonds broken = 612 + 193 = +805
bonds formed = 2 C–Br + 348
ΔH = –77.8 = +805 – (2C–Br + 348) = +457 – 2C–Br
2C–Br = 457 + 77.8 = 534.8
C–Br = 267 $kJ\,mol^{-1}$ [3]

(c) (i) $CH_3CH_2CH_2CH_2CHOHCH_2OH$ [1]

(ii) $CH_3CH_2CH_2CH_2CHNH_2CH_2NH_2$ [1]

(iii) $CH_3CH_2CH_2CH_2CHCNCH_2CN$ [1]

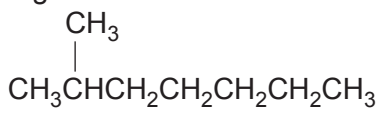
(d) $CH_3CH_2CH_2CH{=}C{=}CH_2$ **or** $CH_3CH_2CH_2CH_2\,C{\equiv}CH$ [1] 18

				AVAILABLE MARKS
13	**(a)**	**(i)**	$CaCO_3.MgCO_3 \rightarrow CaO + MgO + 2CO_2$ **Or** $CaCO_3.MgCO_3 \rightarrow CaO.MgO + 2CO_2$ [1]	
		(ii)	$MgCO_3$ $CaCO_3$ $SrCO_3$ $BaCO_3$ [1]	
		(iii)	as the size/radius of the cation increases polarising power/charge density (of the cation) decreases the carbonate ion is less polarised/distorted [3]	
	(b)	**(i)**	$CaO.MgO + 2H_2O \rightarrow Ca(OH)_2 + Mg(OH)_2$ [1]	
		(ii)	solubility increases as the Group is descended [1]	
		(iii)	$MgCl_2 + Ca(OH)_2.Mg(OH)_2 \rightarrow 2Mg(OH)_2 + CaCl_2$ 95 74 58 2 × 58 111 mass of reactants = 95 + 74 + 58 = 227 mass of magnesium hydroxide = 116 atom economy = 116/227 × 100 = 51.10% = 51% [2]	
		(iv)	$Mg(OH)_2 \rightarrow MgO + H_2O$ [1]	
	(c)	**(i)**	Any two from four: Magnesium magnesium remains [1] the water/solution remains/colourless [1] (small number of) bubbles [1] on the surface [1] [2]	
			Any two from five: Calcium calcium sinks then rises [1] the mass of calcium gets less [1] there are lots of bubbles around the calcium [1] a white solid/milky solution produced [1] heat produced/steamy fumes [1] [2]	
		(ii)	Magnesium the splint stays the same/eventually goes out/no pop [1]	
			Calcium the hydrogen pops/explodes [1]	
		(iii)	Magnesium the solution stays green – neutral/pH7 **or** green/blue – alkaline/pH8/9 [2]	
			Calcium the solution goes blue/violet/purple – alkaline/pH 10–14 [2]	20

14 (a) (i) C_8H_{18} [1]

(ii) $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$ [2]

(iii) e.g.



[1]

(b) $C_8H_{18} = 8 \times 12 + 18 \times 1 = 96 + 18 = 114$
28.5 g = 28.5/114 = 0.25 mol
2 moles of octane react with 25 moles of oxygen
0.25 mole reacts with $0.25 \times 25/2$ = 3.125 mols of oxygen
= 3.125×24 dm^3 = 75 dm^3
Volume of air needed = 5×75 dm^3 = 375 dm^3 [3]
units needed error [–1]

(c) (i) carbon monoxide [1]

(ii) nitrogen and sulfur dioxide/any named noble gas [1]

(iii) $N_2 + O_2 \rightarrow 2NO$ [1]

(d) (i) particulate matter/soot causes damage to the lungs/respiratory problems
the carbon dioxide creates a greenhouse effect/global warming
Incomplete combustion → carbon monoxide → toxic [3]

Quality of written communication [2]

(ii) $2NO \rightarrow N_2 + O_2$
$2CO + O_2 \rightarrow 2CO_2$
$2CO + 2NO \rightarrow 2CO_2 + N_2$ any 2 [2]

(iii) lead covers the surface of the catalyst and stops the catalyst working or poisons the catalyst [1]

AVAILABLE MARKS

18

					AVAILABLE MARKS
15	**(a)**	**(i)**	potassium (reacts with water) to form potassium hydroxide/give alkaline conditions/is a reducing agent	[1]	
		(ii)	ethanol contains the $CH_3CH(OH)$ group	[1]	
		(iii)	yellow	[1]	
		(iv)	antiseptic	[1]	
	(b)		chloroform has a lower mass/number of electrons than iodoform hence the van der Waals forces are greater in iodoform	[2]	
	(c)	**(i)**	butan-1-ol and 2-methylpropan-1-ol are primary butan-2-ol is secondary 2-methylpropan-2-ol is tertiary error [–1]	[2]	
		(ii)	butan-2-ol contains the $CH_3CH(OH)$ group	[1]	
		(iii)	butan-1-ol is a linear molecule/unbranched the van der Waals forces between the chains attract more	[2]	
		(iv)	Na: $CH_3CH_2CH_2CH_2ONa$	[1]	
			$SOCl_2$: $CH_3CH_2CH_2CH_2Cl$	[1]	
			HBr: $CH_3CH_2CH_2CH_2Br$	[1]	
	(d)	**(i)**	bonds vibrate and absorb the infrared radiation	[1]	
		(ii)	the –OH group	[1]	
		(iii)	the infrared spectrum of the unknown butanol is matched to one of the butanol spectra	[1]	
	(e)		$CH_3CHOHCH_2CH_3 + CH_3COOH \rightleftharpoons CH_3COOCH(CH_3)CH_2CH_3 + H_2O$	[2]	19
				Section B	**80**
				Total	**100**