Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2016

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC122]

WEDNESDAY 22 JUNE, MORNING

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

Section B

AVAILABLE MARKS

11 **(a)** Moves to the left since the forward reaction is endothermic [1]

Decreases, fewer collisions with the activation energy [1]

(b) Moves to the right since more molecules on right hand side [1]

Decreases, the molecules are further apart and so fewer successful collisions [1]

(c) No change, the catalyst speeds up the forward and reverse reactions equally [1]

Faster as it provides alternative pathway of lower activation energy [1] 6

12 **(a)** The enthalpy change for a reaction is independent of the route taken provided the initial and final conditions remain the same [2]

(b) **(i)** The enthalpy change when one mole of a compound is formed from its elements under standard conditions/25 °C and 1 atmosphere pressure [2]
([–1] for each mistake)

(ii) Hydrogen is an element [1]

(iii) $-393.5 + 0 + \Delta H = -74.8 + 2(-241.8)$
$\Delta H = -558.4 + 393.5$
$\Delta H = -164.9 \text{ kJ mol}^{-1}$
([–1] for each mistake) [3]

(c) **(i)** $\{(2 \times 803) + (4 \times 436)\} - \{(4 \times 413) + (4 \times 463)\}$
$\{1606 + 1744\} - \{1652 + 1852\}$
$3350 - 3504 = -154 \text{ kJ mol}^{-1}$
([–1] for each mistake) [3]

(ii) The energy required to break one mole of a given bond averaged over many compounds [2]

(iii) Average bond enthalpy values give an estimate of the value as they are not specific to the compounds involved in the reaction [1] 14

13 **(a)** The outer electrons are in the s-subshell [1]

(b) Witherite is more stable [1]
Cation is larger/has lower charge density [1]
Cation has less polarising effect on the carbonate ion [1]
(or converse using magnesite) [3]

(c) **(i)** $BaCO_3 \rightarrow BaO + CO_2$ [1]

(ii) $4BaO + 2Al \rightarrow 3Ba + Ba(AlO_2)_2$ [1]

(d) **(i)** $Mg^{2+} + 2e^- \rightarrow Mg$ [1]

(ii) $2Cl^- \rightarrow Cl_2 + 2e^-$ [1]

(iii) Bleaches
damp litmus/universal indicator paper [2]

(e) Solution of Epsom salts [1]
White precipitate with carbonate and no change with hydrogencarbonate [1] [2]

(f) **(i)** $Ba(g) \rightarrow Ba^+(g) + e^-$
(equation [1], state symbols [1]) [2]

(ii) More protons than electrons/greater effective nuclear charge [1]
Nucleus has a greater attraction for the outer electron [1] [2]

(iii) Outer electron is further from the nucleus [1]
Greater shielding from the inner electrons [1] [2]

AVAILABLE MARKS

18

14 **(a)** **(i)** ultraviolet light [1]

(ii) (free) radical substitution [1]

(iii) Cl_2CHCH_3 [1]

1,1-dichloroethane [1]

(iv) many chlorinated products are formed
low yield or poor atom economy
product is explosive/difficult to separate/takes time/extra cost
(any two) [2]

(b) **(i)** catalyst [1]

(ii) cool the mixture [1]

ethene and chlorine are gases, 1,2-dichloroethane is a liquid [1]

(c) **(i)** $ClCH_2CH_2Cl + KOH \rightarrow CH_2 = CHCl + KCl + H_2O$ [2]

(ii) both of the chlorine atoms will be eliminated/removed [1]

(iii) breaking down (large) molecules into smaller molecules using heat [1]

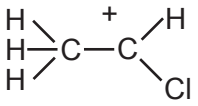
(d) **(i)** $CH_3CHClBr$ [1]

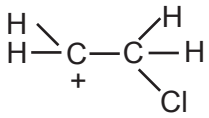
CH_2BrCH_2Cl [1]

(ii) 1-bromo-1-chloroethane [1]

1-bromo-2-chloroethane [1]

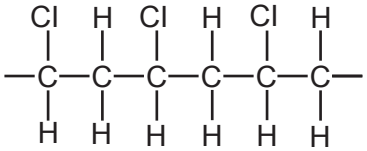
(iii)





[2]

(e)



[2]

AVAILABLE MARKS

21

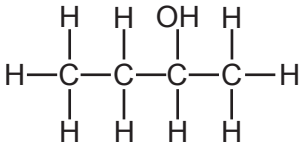
15 (a) Derived from biological material which burns to release energy [1]

(b) Anaerobic/no oxygen [1]
20–40°C [1] [2]

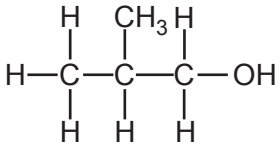
(c) Facilitates/speeds up the following conversions [1]
Carbon monoxide converted to carbon dioxide [1]
Hydrocarbons converted to CO_2 and H_2O [1]
Nitrogen oxides converted to nitrogen [1] [4]

Quality of written communication [2]

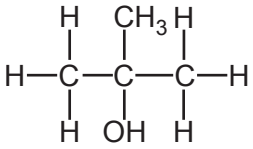
(d) (i)



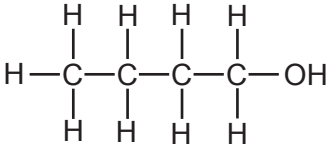
butan-2-ol



2-methylpropan-1-ol



2-methylpropan-2-ol



butan-1-ol

(error [–1]) [4]

(ii) Reagent acidified potassium dichromate/H^+ and $Cr_2O_7^{2-}$ [1]
Names of products:
butanoic acid, butanone, 2-methylpropanoic acid [3] [4]

(e) (i) $C_4H_9OH + 6O_2 \rightarrow 4CO_2 + 5H_2O$ [1]

(ii) Energy required:
$\Delta H = mc\,\Delta T = 250 \times 4.2 \times 80 = 84\,000\,J\ (84\,kJ)$ [1]
Moles of butan-1-ol required = 84/2675 = 0.0314 [1]
Mass of butan-1-ol required = 0.0314 × 74 = 2.32 g [1]
([–1] for each mistake) [3]

	AVAILABLE MARKS
	21
Section B	**80**
Total	**100**