StudentBounty.com

Rewarding Learning

**ADVANCED**
**General Certificate of Education**
**2013**

# Chemistry

## Assessment Unit A2 1

*assessing*

Periodic Trends and Further Organic, Physical and Inorganic Chemistry

**[AC212]**

**THURSDAY 23 MAY, MORNING**

# MARK SCHEME



www.StudentBounty.com
Homework Help & Pastpapers

## General Marking Instructions

### Introduction

Mark schemes are published to assist teachers and students in their preparation for examinati... Through the mark schemes teachers and students will be able to see what examiners are lookin... in response to questions and exactly where the marks have been awarded. The publishing of the m... schemes may help to show that examiners are not concerned about finding out what a student does n... 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 finalised.

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.



StudentBounty.com
www.StudentBounty.com
Homework Help & Pastpapers

## Section A

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



StudentBounty.com

www.StudentBounty.com
Homework Help & Pastpapers

StudentBounty.com

## Section B

**11** **(a)** sodium oxide **or** magnesium oxide **or** aluminium oxide [1]

**(b)** $Al_2O_3$ [1]

**(c)** $SO_2 + 2NaOH \rightarrow Na_2SO_3 + H_2O$ [2]

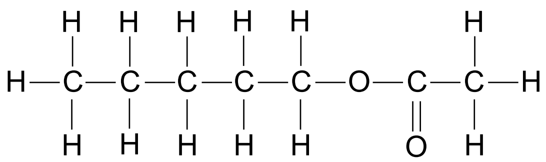
**(d)** covalent [1]
giant/macromolecular [1] [2]

**(e)** aluminium oxide/silicon dioxide [1]

**(f)** $Cl_2O_7 + H_2O \rightarrow 2HClO_4$ [2]

**(g)** phosphoric acid/phosphoric(V) acid [1] 10

**12** **(a)**



[1]

**(b)** **(i)** $K_c = \dfrac{[C_5H_{11}OOCCH_3][H_2O]}{[C_5H_{11}OH][CH_3COOH]}$ [1]

**(ii)** converting g to mols

| | $C_5H_{11}OH$ | + $CH_3COOH$ | $\rightleftharpoons$ $C_5H_{11}OOCCH_3$ | + $H_2O$ |
|---|---|---|---|---|
| initial moles | 0.0125 | 0.02 | 0 | 0 |
| equilibrium moles | 0.0025 | 0.01 | 0.01 | 0.01 |

$K_c = \dfrac{(0.01)(0.01)}{(0.0025)(0.01)} = 4$ [−1] for each error [4]

**(iii)** endothermic [1]
more product/reaction moves to RHS [1] [2] 8



www.StudentBounty.com
Homework Help & Pastpapers

StudentBounty.com

**13 (a) (i)**

| | | |
|---|---|---|
| K | +1 | +1 |
| N | +5 | 0 |
| O | −2 | −2 |
| C | 0 | +4 |
| S | 0 | −2 |

[2]

**(ii)** N reduced from +5 to 0
C oxidised from 0 to +4
S reduced from 0 to −2
oxidation and reduction occurring simultaneously [2]

**(b)** $n\ KNO_3 = \frac{6}{101} = 0.059$ 2

$n\ C = \frac{1}{12} = 0.0833$ 3 limiting.

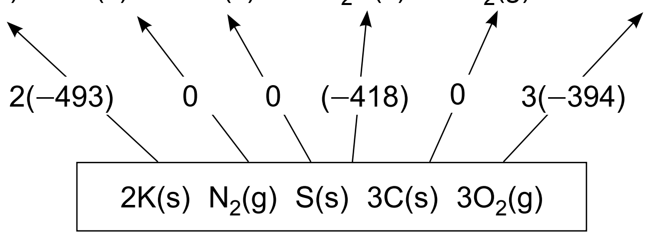
$n\ S = \frac{1}{32} = 0.03125$ 1

$(3 : 1)\ n\ N = \frac{0.0833}{3} = 0.0278$

$(3 : 3)\ n\ CO_2 = 0.0833$

$0.0278 + 0.0833 = 0.111 \times 24 = 2.67\ dm^3$ [4]

**(c)** $2KNO_3(s) + S(s) + 3C(s) \rightarrow K_2S(s) + N_2(g) + 3CO_2(g)$




$\Delta H_r = -2(-493) + (-418) + 3(-394)$
$= -614$ kJ
[−1] for each error

**or**

$2KNO_3(s) \rightarrow 2K(s) + N_2(g) + 3O_2(g)$ $+2 \times 493$
$2K(s) + S(s) \rightarrow K_2S(s)$ $-418$
$3C(s) + 3O_2(g) \rightarrow 3CO_2(g)$ $-3 \times 394$

---

$2KNO_3(s) + S(s) + 3C(s) \rightarrow K_2S(s) + N_2(g) + 3CO_2(g)$
$\Delta H = +2 \times 493 - 418 - 3 \times 394$
$= +986 - 418 - 1182$
$= -614$ kJ [3]

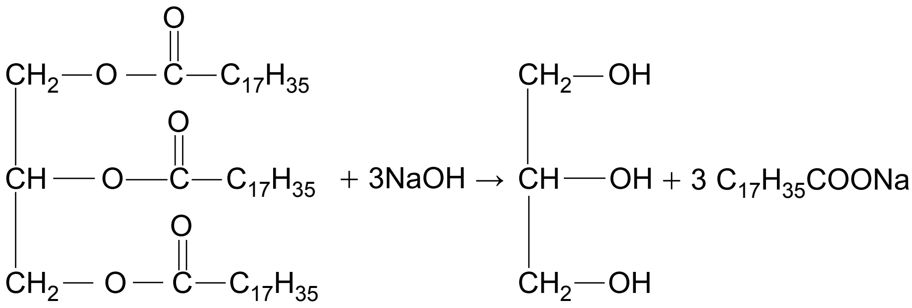
**(d) (i)** $\Delta S^{\ominus} = \Sigma S^{\ominus}$ (products) $- \Sigma S^{\ominus}$ (reactants)
$= 3(214) + 191 + 115 - 2(172) - 32 - 3(5.7)$
$= +554.9\ J\ K^{-1}\ mol^{-1}$
[−1] for each error [2]

**(ii)** $\Delta G^{\ominus} < 0$ [1]
(always) exothermic and $\Delta S^{\ominus} > 0$ [1] [2] 15



www.StudentBounty.com
Homework Help & Pastpapers

**14 (a) (i)**



[3]

error [–1]

**(ii)** molecular formula: $C_{57}H_{110}O_6$ [1]
RMM: 890 [1] [2]

**(iii)** number of mg of KOH to completely hydrolyse 1 g of fat/oil [2]

**(iv)** moles of glyceryl tristearate = $\frac{1}{890} = 1.1236 \times 10^{-3}$ [1]

moles of KOH required = $1.1236 \times 10^{-3} \times 3 = 3.3708 \times 10^{-3}$ [1]
mass of KOH = $3.3708 \times 10^{-3} \times 56 = 0.1888$ g [1]
mg of KOH required = 188.8 [1] [4]

**(b) (i)** mass of iodine in g [1]
which will react with/saturate 100 g of the fat/oil [1] [2]

**(ii)** no C═C/saturated [1]

**(iii)** known mass of oil (and dissolve in a suitable (saturated) solvent) [1]
add Wijs solution and stand in the dark for 30 minutes [1]
add KI(aq) (and water) and titrate (liberated iodine) with standard sodium thiosulfate solution [1]
add starch indicator when pale straw colour [1]
end point reached when changes from blue-black to colourless [1]
repeat using a blank with no oil [1] maximum [6]

Quality of written communication [2]

**(iv)** Comment on van der Waals forces [1]
Comment on shape/packing [1] [2] 24

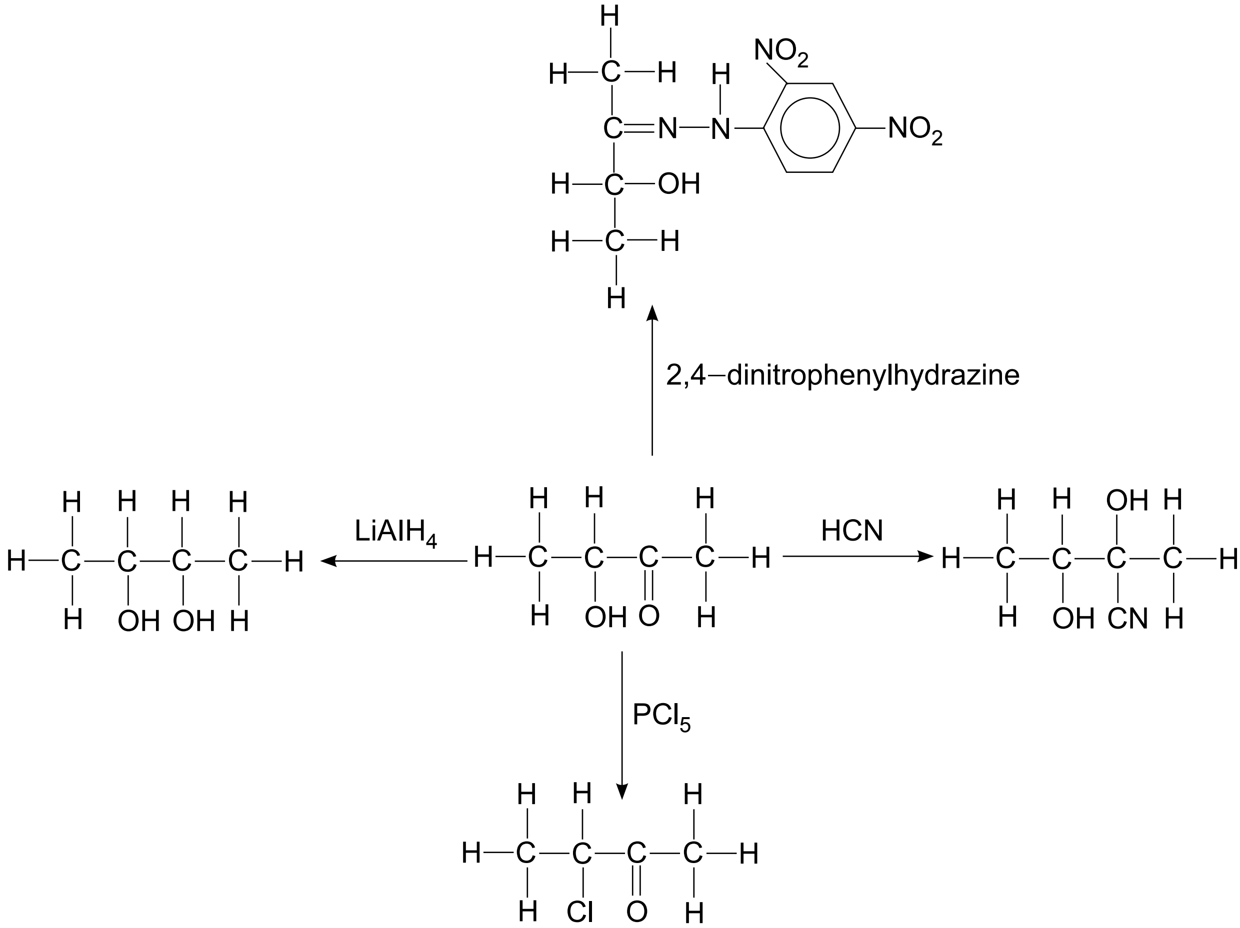


www.StudentBounty.com
Homework Help & Pastpapers

**15** **(a)** **(i)** 3-hydroxybutanone [2] Award [1] for 2-hydroxybutanone [2]

**(ii)** hydrogen bonds with water [1]
statement on where H-bond forms [1] [2]

**(iii)**




[1] for each correct structure [4]

**(iv)** nucleophilic [1] addition [1] [2]

**(b)** **(i)** $CH_3CH(OH)COCH_3 + [O] \rightarrow CH_3COCOCH_3 + H_2O$ [2]

**(ii)** orange [1] to green [1] [2]

**(iii)** acetoin order = 2
$H^+$ order = 1
$Cr_2O_7^{2-}$ order = 1 [2]

**(iv)** rate = $k[\text{acetoin}]^2[H^+][Cr_2O_7^{2-}]$ [1]

**(v)** 4.36 [1] $mol^{-3}\ dm^9\ s^{-1}$ [1] [2]
e.g. $4.36 \times 10^{-3} = k[0.1]^2\ [1.0]\ [0.1]$
$4.36 \times 10^{-3} = k \times 10^{-3}$
$k = 4.36$



StudentBounty.com
www.StudentBounty.com
Homework Help & Pastpapers

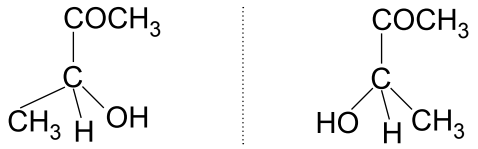
StudentBounty.com

BLE

(c) (i) rotates the plane [1] of plane polarised light [1] [2]

(ii) four different groups [1] attached to the same carbon atom [1] [2]
allow [1] for contains a chiral centre

(iii)




[2]

(iv) equal concentrations of isomers [1]
idea that net rotation is zero [1] [2] 27

**16** (a) standard enthalpy of formation = E [1]
first electron affinity of iodine = D [1]
first ionisation energy of potassium = B [1]
standard enthalpy of atomisation of potassium = A [1] [4]

(b) −(−327.6) + (+89.5) + (+420.0) + (+106.6) + (−295.4)
= + 648.3 [2]

(c) (i) enthalpy of atomisation/bond enthalpy (C)
first electron affinity (D)
enthalpy of formation (E) [3]

(ii) enthalpy of atomisation for $Cl_2$ > $I_2$ because bond energy greater [1]
electron affinity for Cl > Br because the atomic radius is smaller/
shielding [1] enthalpy of formation for KCl > KBr because chlorine
is more reactive [1] [3]

(d) (i) KCl(s) + aq → $K^+$(aq) + $Cl^-$(aq) [2]

(ii) +710 − 305 − 384 = +21 (kJ $mol^{-1}$) [2] 16

**Section B** **100**

**Total** **120**



www.StudentBounty.com
Homework Help & Pastpapers