Published Mark Scheme for GCE A2 Chemistry

January 2010

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NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE)
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)

MARK SCHEMES (2010)

Foreword

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 16- and 18-year-old 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 a 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.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

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Rewarding Learning

ADVANCED
General Certificate of Education
January 2010

Chemistry

Assessment Unit A2 1

assessing

Periodic Trends and Further Organic, Physical and Inorganic Chemistry

[AC211]

WEDNESDAY 27 JANUARY, MORNING

MARK SCHEME

Section A

1 C

2 A

3 D

4 B

5 A

6 B

7 B

8 C

9 B

10 B

2 marks for each correct answer [20]

Section B

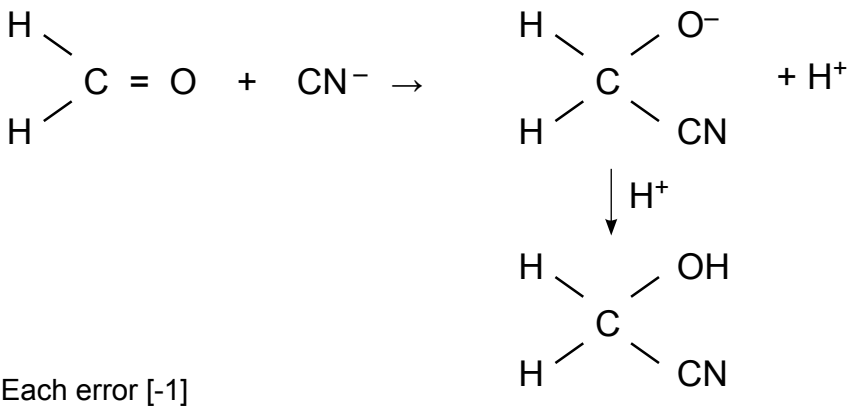
11 **(a)** hydrogen bonds [1]
between oxygen (in methanal) and hydrogen atoms (in water) [1] [2]

(b) **(i)** $HCHO + [O] \rightarrow HCOOH$ [1]

(ii) $Ag^+ + e^- \rightarrow Ag$ [1]

(iii) silver mirror [1]

(c)



Each error [-1] [3]

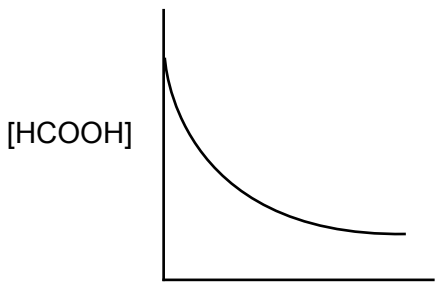
(d) **(i)** colorimetry [1]
measure absorbance / transmission [1]
with time [1]
use calibration curve [1]
} 3 from 4
plot bromine concentration against time
or rate against bromine concentration [1] [4]

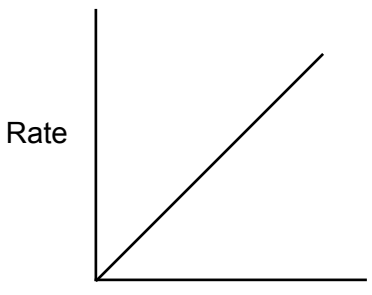
measure CO_2 volume [1]
with time [1]
repeat with different bromine concentrations [1]
(plot volume against time) measure tangent at t = 0 [1]
} 3 from 4
plot rate against $[Br_2]$ [1] [4]

QWC [2]

(ii) $mol^{-1}\ dm^3\ s^{-1}$ [1]

(iii) start on y axis curve down [1]
straight line of positive slope through % [1] [2]





(e) **(i)** $HCOOH + C_2H_5OH \rightarrow HCOOC_2H_5 + H_2O$
missing water = [-1] [2]

(ii) ethyl methanoate [1]

(iii) catalyst [1]
drives equilibrium to rhs / improve yield / removes water [1] [2] 22

12 **(a)** vibrate [1]
stretch [1]
bend [1]
absorbs energy/heat [1] [2]

(b) **(i)** $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ [1]

(ii) 220000g = 6875 moles
1 mole O_2 = 1 mole CO_2
6875 × 24
= 165 000 dm^3
Each error [-1]. Carry error through [3]

(iii) $C_6H_{10}O_5 + 6O_2 \rightarrow 6CO_2 + 5H_2O$
Unbalanced = [-1] [2]

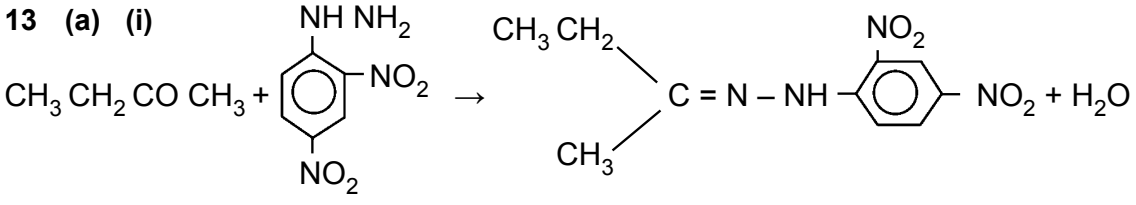
(c) $3.9 \times 10^{13} \times 44/12 = 1.43 \times 10^{14}$ tonnes
Each error [-1] [2]

(d) **(i)** moves to rhs to reduce concentration of CO_2 gas [1]

(ii) $K_c = [HCO_3^-][H^+] / [CO_2][H_2O]$ [1]

(ii) K_c small as HCO_3^- and / or H^+ concentration(s) low [1] 14

13 **(a)** **(i)**



each error [–1] [3]

(ii) yellow or orange [1]

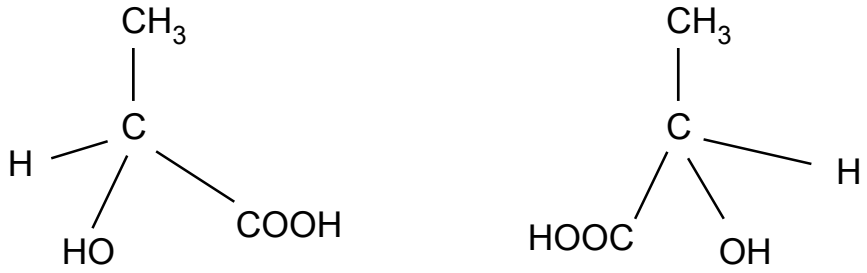
(iii) dissolve in minimum amount [1]
of hot solvent/ethanol [1]
cool/crystallize and filter and dry [1] [1]

(iv) (sealed) capillary tube / m.pt apparatus [1]
heat slowly (½ – 1 degree per minute) [1]
record temperature at which melting starts and finishes / m.pt range [1]
repeat [1]
Any [3] [3]

(v) lower [1]
broader range [1] [2]

(b) **(i)** rotate (plane) [1]
of plane polarised light [1] [2]

(ii)



[2]

(c) **(i)** $CH_3CHOHCOOH + NaOH \rightarrow CH_3CHOHCOONa + H_2O$ [1]

(ii) moles NaOH = 24.3 × 1.0 / 1000 = 0.0243 mole
moles lactic acid = 0.0243 in 25 cm^3
concentration = 0.0243 × 40 = 0.972 (mol dm^{-3})
Each error [-1], carry error through [3]

(iii) 0.972 × 90 = 87.48(g dm^{-3})
Each error [-1], carry error through [2]

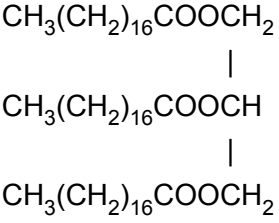
(iv) phenolphthalein [1]

(d)

C	H	O	
58.7	9.8	31.5	
4.89	9.8	1.97	divide by RAM
5	10	2	

$C_5H_{10}O_2$
Each error [-1], carry error through [3]

(e) **(i)**



[2]

(ii) number of mg of potassium hydroxide [1]
needed to neutralise the fatty acids formed by complete hydrolysis [1]
of 1g of fat [1]
high value indicates fatty acid groups have low RMM/short chain [1] [4] 30

14 (a) (i) 0 [1]

(ii) 2-hydroxypropane-1,2,3-tricarboxylic acid [2]

(b) (i) $CH_2(COOH)C(OH)(COOH)CH_2COOH + 3NaHCO_3 \rightarrow$
$CH_2(COONa)C(OH)(COONa)CH_2COONa + 3H_2O + 3CO_2$
unbalanced / not using excess = [-1] [2]

(ii) no fizzing / effervescence / temp. would stop decreasing [1]

(iii) standard [1]
entropy change [1] [2]

(iv) ΔG must be negative [1]
term $T\Delta S > \Delta H$ / $T\Delta S$ more positive than ΔH [1] [2]

(c) (i) $CH_2(COOH)C(OH)(COOH)CH_2COOH \rightarrow$
$CH_2(COOH)C(OH)(COOH)CH_2COO^- + H^+$ [1]

(ii) $K_a = [RCOO^-][H^+] / [RCOOH]$ [1]

(iii) $K_a = [H^+]^2 / 0.1 = 8.4 \times 10^{-4}$
$[H^+]^2 = 8.4 \times 10^{-5}$
$[H^+] = 0.009165 = 2.038$
Each error [-1], carry error through [3] 15

15 (a) (i) moves to lhs / decreases yield [1]
to reduce pressure / volumes / number of gaseous particles [1] [2]

(ii) moves to rhs / increases yield [1]
to remove thermal energy / reduce temperature / favours
endothermic change [1] [2]

(iii) $K_c = [C_2F_4][HCl]^2 / [CHClF_2]^2$

	$CHClF_2$	C_2F_4	HCl
start	0.2	0	0
eqm	0.04	0.08	0.16
conc	0.008	0.016	0.032

$K_c = (0.016) \times (0.032)^2 / (0.008)^2$
$= 0.256$ mol dm^{-3}
units [1]
Each error [-1], carry error through [4]

(iv) produces energy [1]
less land or landfill sites needed / reduces visual impact [1] [2]

(b) **(i)** $Na^+(g) + F(g) + e^-$ [1]
$Na^+(g) + ½F_2(g) + e^-$ [1]
$Na(g) + ½F_2(g)$ [1]
$Na(s) + ½F_2(g)$ [1] [4]

(ii) $-574 + \Delta H_{latt} = 107 + 496 + 158/2 - 333 = 349$
$\Delta H_{latt} = 349 + 574$
$= 923$ kJ mol^{-1}
Each error [-1], carry error through
Use of negative sign [-1] [2]

(iii) $1s^22s^22p^6$ [1]
$1s^22s^22p^6$ [1] [2] 18

Total **100**