GCE A2

Chemistry

January 2009

Mark Scheme

Issued: April 2009

MARK SCHEMES (2009)

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 2009

Chemistry

Assessment Unit A2 1

assessing

Module 4: Further Organic, Physical and Inorganic Chemistry

[A2C11]

FRIDAY 9 JANUARY, AFTERNOON

MARK SCHEME

Quality of Written Communication

2 marks The candidate expresses ideas clearly and fluently through well-linked sentences and paragraphs. Arguments are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.

1 mark The candidate expresses ideas clearly, if not always fluently. Arguments may sometimes stray from the point. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.

0 marks The candidate expresses ideas satisfactorily, but without precision. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the passage.

Section A

1 C

2 C

3 D

4 B

5 C

6 B

7 D

8 A

9 A

10 A

[2] for each correct answer [20] 20

Section A **20**

Section B

11 **(a)** manufacture of superphosphate [1]
which is used as a fertiliser/supply soluble phosphorus [1]

(b) $S + O_2 \rightarrow SO_2$ [1]
$2SO_2 + O_2 \rightleftharpoons 2SO_3$ [1]
$SO_3 + H_2O \rightarrow H_2SO_4$ [1]

(c) sulphur dioxide absorbed in water/alkali/lime [1]
to prevent acid rain [1]

(d) **(i)** $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$ [1]

(ii) before reaction: copper = 0 sulphur = +6
after reaction: copper = +2 sulphur = +4
copper is oxidised and sulphur is reduced [3]

(e) the strongest acid has the highest oxidation number/sulphuric acid is the strongest acid
thiosulphurous acid S = +2; sulphuric acid +6 [2]

(f) **(i)** $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ [2]

(ii) white [1] precipitate [1] from colourless [1] solutions (to max 2) [2]

(iii) mol of sulphuric acid = $19 \times 10^{-3} \times 0.01 = 1.9 \times 10^{-4}$ mol
0.16 g of barium chloride dissolved in 1000 cm^3
0.16/20 g dissolved in 50 $cm^3 = 8 \times 10^{-3}$ g
one mol of barium chloride = 71 + 137 = 208
8×10^{-3} g = $8 \times 10^{-3}/208 = 3.85 \times 10^{-5}$ mol
hence the sulphuric acid is in excess
$BaSO_4$ = 137 + 32 + 64 = 233
mass of barium sulphate = $233 \times 3.85 \times 10^{-5} = 8.97 \times 10^{-3}$ g = 9 mg [4] 21

12 **(a)** acid partially ionises/dissociates [1]
producing (a low concentration of) hydrogen ions [1]

(b) ethanol oxidised [1]
ethanoic acid produced [1]

(c) concentration = 5.10×10^{-8} mol cm^{-3}
= 5.10×10^{-5} mol dm^{-3}
pH = $-\log (5.10 \times 10^{-5}) = 4.3$ [2]

(d) **(i)** $K_w = [H^+][OH^-]$ [1]

(ii) as the temperature goes up the value of K_w increases
hence the reaction goes to the RHS [1]
the reaction must be endothermic [1]

(e) **(i)** e.g. glucose [1]

(ii) amylose and amylopectin [1]

(f) **(i)** $H_2CO_3 \rightleftharpoons HCO_3^- + H^+$
addition of acid causes equilibrium to move to LHS/reacts with hydrogencarbonate ion [1]
addition of alkali causes equilibrium to move to RHS/reacts with hydrogen ions [1]

(ii) $pH = pK_a + \log [CH_3CO_2Na]/[CH_3CO_2H]$
$pK_a = -\log (1.86 \times 10^{-5}) = 4.73$
$5.8 = 4.73 + \log [CH_3CO_2Na]/[CH_3CO_2H]$
$1.07 = \log[CH_3CO_2Na]/[CH_3CO_2H]$
$11.75 = [CH_3CO_2Na]/[CH_3CO_2H] = [CH_3CO_2Na]/0.01$
$[CH_3CO_2Na] = 0.1175$ mol dm^{-3}
$CH_3CO_2Na = 24 + 3 + 32 + 23 = 82$
1.175 mol $= 0.1175 \times 82 = 9.635$ g
9.635 g in 1 dm^3 hence 4.82 g in 500 cm^3 [4] 17

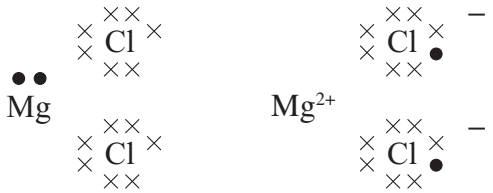
13 **(a)** **(i)** $Mg^{2+}(g) + 2Cl(g) + 2e^-$
$Mg^{2+}(g) + 2Cl^-(g)$ [2]

(ii) $+ 148 + 738 + 1451 + 242 - 696 = -641 + U$
$U = 3220 - 696 = +2524$ [2]

(iii) lattice enthalpy is the energy/enthalpy needed to separate the Mg^{2+} and Cl^- ions in a lattice to an infinite distance/long way [2]

(iv) the variables are bond energies and electron affinities
the bond energies decrease and decrease U
the electron affinities become less negative and increase U
bond energy is more important [2]

(b)



[3]

	(c)	misty fumes (of HI) yellow solid (due to sulphur) black solid (due to solid iodine) smell of hydrogen sulphide gas smell of sulphur dioxide white solid at start violet/purple fumes (of iodine vapour) to a maximum of [3] the sulphuric acid oxidises HI/MgI_2 the phosphoric acid does not oxidise both acids react with MgI_2 to give HI to a maximum of [2]	[5]		
		Quality of written communication	[2]		18
14	**(a)**	**(i)** saturated fats provide energy/insulation/protection unsaturated lower cholesterol building blocks for prostaglandins mixture means less saturated fats	[2]		
		(ii) one	[1]		
		C=C double bond in the molecule	[1]		
		(iii) e.g. oleic acid	[1]		
		(iv) propane-1,2,3-triol	[2]		
	(b)	**(i)** 3 mol of KOH are needed to react with 1 mol of a triglyceride 3.3×10^{-3} mol react with 1.1×10^{-3} mol of the triglyceride number of moles = $0.0011/1.1 \times 10^{-3}$	[1]		
		(ii) 1.1×10^{-3} mol have a mass of 1.2 g 1 mol has a mass of $1.2/1.1 \times 10^{-3} = 1.091 \times 10^3$ $= 1091$	[1]		
		(iii) 5.38×10^{-3} mol of hydrogen react with 1.1×10^{-3} mol of the triglyceride 5.38/1.1 = 4.9 mol of hydrogen react with 1 mol of triglyceride each mol of the triglyceride contains 3 mol fatty acid hence each fatty acid contains 1.6 double bonds	[1]		
		(iv) nickel	[1]		
		(v) dissolve in a named non-aqueous solvent e.g. trichlorethane	[1]		
		add iodine/bromine solution (aqueous or suitable solvent)	[1]		
		if no double bonds no change in colour	[1]		14
				Section B	**70**
				Total	**90**