GCE AS

Chemistry

January 2009

Mark Schemes

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

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 SUBSIDIARY (AS)
General Certificate of Education
January 2009

Chemistry

Assessment Unit AS 1
assessing
Module 1: General Chemistry

[ASC11]

FRIDAY 16 JANUARY, MORNING

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.

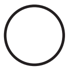
1 mark The candidate expresses ideas clearly, if not always fluently. Arguments may sometimes stray from the point. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.

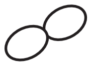
0 marks The candidate expresses ideas satisfactorily, but without precision. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the passage.

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

Section B

11 green [1]
lilac [1]
yellow/orange [1]

12 **(a)**  [1]

(b)  or  or  [1]

(c) $1s^2 2s^2 2p^2$ [1] 6

13 **(a)** bonds broken

1B—B = 1 × 293 = 293
6B—H = 6 × 389 = 2334
6F—F = 6 × 158 = 948 total = 3575

bonds formed

6H—F = 6 × 566 = 3396
6B—F = 6 × 627 = 3762 total = 7158

enthalpy change = 3575 – 7158 = –3583 [3]

(b) hydrogen fluoride; no change observed [1]
hydrogen iodide; violet vapour observed [1]

(c) $B_2H_6 = 2 \times 11 + 6 \times 1 = 22 + 6 = 28$
7.0 g of diborane $= \frac{7}{28} = 0.25$ mol
1 mol of diborane forms 8 mol of gases
0.25 mol of diborane forms 2.0 mol of gases

2.0 mol of gases occupies $2.0 \times 24\,dm^3 = 48\,dm^3$ [3]

(d) trigonal planar [1]
bonding pairs repel equally [1] 10

ABLE ...S

14 **(a)** **(i)** can be hammered/bent [1]
into a new shape [1] [2]

(ii) can be stretched [1]
into wires [1] [2]

(iii) electrons delocalised [1]
move and current flows [1]

(b) **(i)** e.g. sodium chloride [1]

(ii) silver nitrate [1]

(iii) $Ag^+ + Cl^- \rightarrow AgCl$ [1]

(c) **(i)** AgCl = 108 + 35.5 = 143.5 [1]

(ii) $0.4 \times \frac{10^{-3}}{143.5} = 2.79 \times 10^{-6}$ [1]

(iii) $4 \times 2.79 \times 10^{-6} = 1.116 \times 10^{-5} = 1.12 \times 10^{-5}$ [1]

(iv) ammonia solution [1]

(v) goes grey/black [1]
silver is formed/light energy causes electron transfer [1] 15

15 **(a)** **(i)** $MgBr_2 + Cl_2 \rightarrow MgCl_2 + Br_2$ [2]

(ii) Br^- loses electrons [1]
Cl_2 receives electrons [1]
loss of electrons is oxidation and gain of electrons is reduction [1]

(b) 1 mol $Br_2 = 2 \times 80 = 160$ g
160 g occupy 51 cm^3
$\frac{160}{51}$ g occupy 1 cm^3
density = 3.14 g cm^{-3} [2]

(c) **(i)** e.g. hexane [1]

(ii) bromine is slightly/moderately soluble [1]
iodine is insoluble [1]

(iii) sodium chloride: no effect/orange colour diluted [1]
sodium iodide: brown/black colour produced [1]

ABLE

(d) **(i)** $2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ [2]

(ii) iodine in flask and thiosulphate in burette [1]
add thiosulphate until straw yellow [1]
add starch [1]
add thiosulphate until the blue/blue-black colour [1]
disappears/colourless [1]

Quality of written communication [2] 21

16 **(a)** two [1]
carboxylic acid groups [1]

(b)

$$\begin{matrix} COOH \\ | \\ COOH \end{matrix} + 2NaOH \rightarrow \begin{matrix} COONa \\ | \\ COONa \end{matrix} + 2H_2O$$

[2]

(c) alkali: pink/red [1]
acid: colourless [1]

(d) concentrated [1]
ammonia solution [1]
white fumes [1]

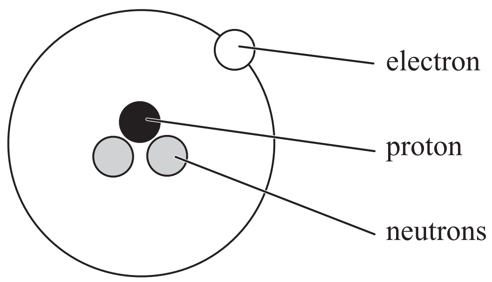
(e)

element	moles	ratio
C	$\frac{18.9}{12} = 1.575$	1
Cl	$\frac{55.9}{35.5} = 1.575$	1
O	$\frac{25.2}{16} = 1.575$	1

empirical formula = COCl [3] 12

ABLE
S

17 (a)



[2]

(b) protium [1]
value nearest to 1 [1]

(c) (i) second energy level [1]

(ii) $E = hf = 6.63 \times 10^{-34} \times 4.568 \times 10^{14} = 3.0286 \times 10^{-19}$ J

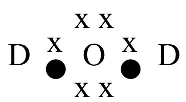
For one mole $= 3.0286 \times 10^{-19} \times 6.0 \times 10^{23}$ J

$= 1.82 \times 10^{5}$ J mol^{-1}
$= 182$ kJ mol^{-1} [3]

(iii) the higher energy levels get closer together [2]

(d) (i) hydrogen bonding [1]
van der Waals forces [1]

(ii)



[2]

(iii) $D_2O + D^+ \rightarrow D_3O^+$ [1]

(iv) dative bond [1] 16

Section B	**80**
Total	**100**

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2009

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[ASC21]

TUESDAY 20 JANUARY, MORNING

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.

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ABLE
S

Section A

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

ABLE

Section B

11 gasoline [1]
naphtha [1]
kerosene [1] 3

12 $Cl_2 \rightarrow 2Cl^{\bullet}$
$Cl^{\bullet} + CH_4 \rightarrow CH_3^{\bullet} + HCl$
$CH_3^{\bullet} + Cl_2 \rightarrow CH_3Cl + Cl^{\bullet}$
$CH_3^{\bullet} + CH_3^{\bullet} \rightarrow C_2H_6$ [3] 3

13 **(a)** $N_2 + 3H_2 \rightleftharpoons 2NH_3$ [2]

(b) iron [1]

(c) more molecules on the left hand side [1]
equilibrium moves to the right [1]

reaction is exothermic [1]
hence low temperature to move equilibrium to right [1]

(d) concentrated hydrochloric acid [1]
white smoke/fumes [1] 9

14 **(a)** **(i)** carbon attached to two hydrogens and an OH group [2]

(ii)

CH_2Br	CH_2ONa	CH_2Cl	CH_2Cl
|	|	|	|
CH_2Br	CH_2ONa	CH_2Cl	CH_2Cl

[4]

(b) H bonding between [1]
OH groups and water [1]

(c) **(i)** acidified (potassium) dichromate/formula
acidified (potassium) manganate(VII)/formula [1]

(ii) aldehydes [1]

(d) no (dependent on explanation) [1]
because CH_3CHOH– is not present [1]

(e) **(i)** liver damage/affects behaviour [1]

(ii) $100\,cm^3$ is 80 g
$CH_2OHCH_2OH = 24 + 6 + 32 = 62$
$80\,g = 80/62 = 1.29$ mol [3] 16

ABLE ...S

15 (a) (i) $BaCO_3 + 2HCl \rightarrow BaCl_2 + CO_2 + H_2O$ [2]

(ii) milky/chalky/white [1]

(iii) $BaCO_3 = 137 + 12 + 48 = 197$
$0.66\,g = 0.66/197 = 0.00335$ mol
0.00335 mol $= 0.00335 \times 24\,dm^3 = 0.0804\,dm^3$ or $80.4 / 80\ cm^3$ [3]

(iv) green [1]

(b) (i) $0.86\,mg = 0.86 \times 10^{-3}\,g$
mol of barium carbonate $= 0.86 \times 10^{-3}/197 = 0.00436 \times 10^{-3}$
$= 4.4 \times 10^{-6}$ mol in $100\ cm^3$
solubility $= 4.4 \times 10^{-5}\ mol\ dm^{-3}$ [3]

(ii) $BaCl_2 + MgSO_4 \rightarrow MgCl_2 + BaSO_4$ [2]

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

(ii) cation size of Ba is greater than that of Be [1]
lattice enthalpy of $BaCO_3$ greater than $BeCO_3$ [2]

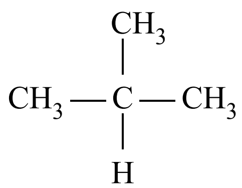
(iii) $BaCO_3 + C \rightarrow BaO + 2CO$ [2] 18

16 (a) (i) $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$ [2]

(ii) water [1]
carbon monoxide [1]

(iii) limited supply of oxygen/air [1]

(b) (i)



[2]

(ii) water and carbon dioxide [2] 9

17	(a)	(i)	greater surface area	[1]	
			faster reaction/more economical	[1]	
		(ii)	molecules adsorbed on the surface/interaction with d orbitals of metal	[1]	
			activation energy lowered	[1]	
			bonds weakened or broken	[1]	
			orientation of molecules on the surface	[1]	
			to a maximum of [3]		
	(b)		lead (or compounds) coats the surface	[1]	
			stops catalysis/reaction taking place	[1]	
	(c)		carbon dioxide	[1]	
			carbon dioxide and water	[1]	
			nitrogen	[1]	10
18	(a)		(vapour of hydrocarbon passed over hot) catalyst	[1]	
			molecule broken down into smaller parts	[1]	
	(b)		flexibility of HD polythene is low	[1]	
			softening temperature of HD polythene is high	[1]	
			polythene molecule is not branched	[1]	
			packing is closer/intermolecular forces greater/more crystalline	[1]	
			Quality of written communication	[2]	
	(c)	(i)	molecules do not break down	[1]	
			by the action of microbes/bacteria/microorganisms	[1]	
		(ii)	provides energy – essential	[1]	
			not sufficient landfill sites etc	[1]	12
				Section B	**80**
				Total	**100**