Published Mark Schemes for GCE AS Chemistry

January 2010

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NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCA SE)
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION

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 SUBSIDIARY (AS)
General Certificate of Education
January 2010

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC111]

THURSDAY 14 JANUARY, MORNING

MARK SCHEME

Section A

1 C

2 C

3 D

4 B

5 C

6 B

7 B

8 B

9 A

10 B

[2] for each correct answer	[20]	20
	Section A	**20**

Section B

11 (a)

Particle	Relative mass	Relative charge
Proton	1	+ 1
Electron	$\frac{1}{1840}$	– 1
Neutron	1	0

1 mark per particle [3]

(b) Number of protons + Number of neutrons [1]

Number of protons [1]

Atoms which have the same number of protons but different numbers of neutrons [1]

(c) (i) Cl [1] 35 [1] [2]

(ii)

Ion	Atomic Number	Mass Number	Number of Neutrons	Electronic Structure
X^{2+}	**20**	**40**	20	$1s^22s^22p^63s^23p^6$
Y^{-}	**17**	**35**	18	$1s^22s^22p^63s^23p^6$
Z^{2-}	**8**	16	**8**	$1s^22s^22p^6$

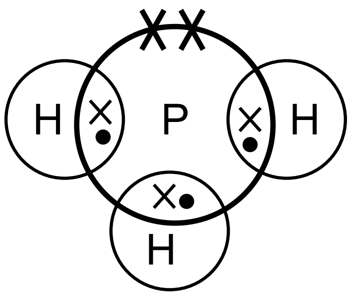
1 mark per particle [3]

(d) (i) The average mass of an atom of an element [1] relative to (one twelfth of) the mass of an atom of carbon-12. [1] [2]

(ii) [(70 × 20.55) + (72 × 27.37) + (73 × 7.67) + (74 × 36.74) + (76 × 7.67)] ÷ 100

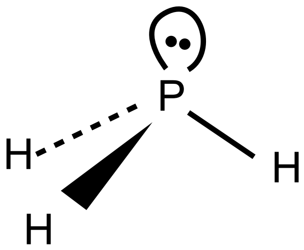
72.7 [2] 15

12 (a) (i)



[2]

(ii)



[1]

Pyramidal [1]

(iii) In the outer shell of the central P atom there are
(3) bonding pairs and (1) lone pair of electrons [1] which repel [1] [2]

(iv) approximately 107° [1]
Lone pair-bonding pair repulsion is greater than
bonding pair-bonding pair repulsion [1] [2]

(b) (i) coordinate (dative covalent) bond [1]

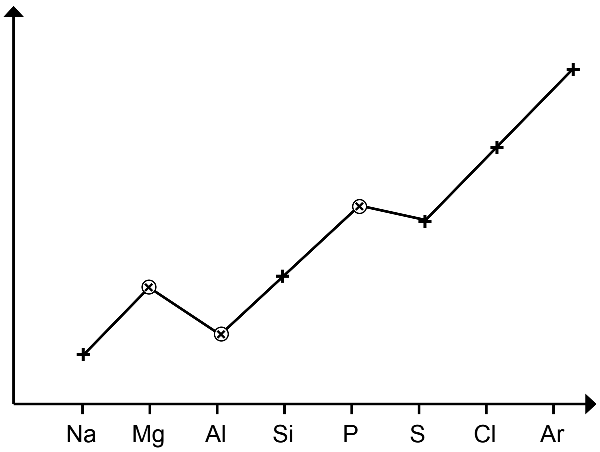
(ii) the phosphorus atom shares its lone pair with the H^+ ion [2]

(c) Hydrogen bonding in ammonia [1]
is stronger than dipole-dipole (or van der Waals') in phosphine [1] [2] 13

					AVAILABLE MARKS
13	**(a)**	**(i)**	Phenolphthalein	[1]	
		(ii)	colourless [1] to pink [1]	[2]	
	(b)	**(i)**	$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$	[2]	
		(ii)	21.4 and 21.3 into table Average titre = 21.35 cm^3	[1] [1]	
		(iii)	$0.1 \times (21.35/1000) = 2.135 \times 10^{-3}$	[1]	
		(iv)	$(2.135 \times 10^{-3}) \div (0.025) = 0.0854$	[1]	
		(v)	0.854	[1]	
	(c)		Rinsing the pipette (2-3 times) with undiluted vinegar Use of pipette filler Meniscus on mark Mixing/inverting solution in volumetric flask Rinsing the pipette (2-3 times) with diluted vinegar Max = 4	[4]	
			Quality of written communication	[2]	16

14 **(a)** Energy required to convert one mole of gaseous atoms to gaseous ions with single positive charges. [2]

(b) **(i)**



Point for Mg above Na but not above that for Si
point for Al below that for Mg but not below Na [1]

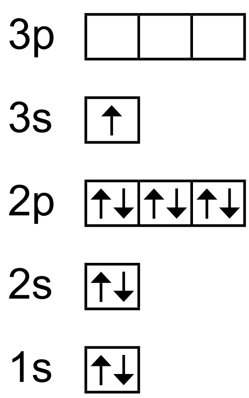
Point for P above that for S and below that for Cl [1]

(ii) increasing nuclear charge [1]
Shielding approximately constant/atomic radius decreases [1]

(iii) $1s^2 2s^2 2p^6 3s^2$ [1]

(iv) (stability of) filled subshell for Mg atom [1]
Stability not present in aluminium/$3p^1$/outer electron is in higher energy subshell [1] [2]

(c) **(i)**



Labels [1] Configuration [1] [2]

(ii) Al^{3+} (g) → Al^{4+} (g) + e^- [2]

(iii) Outer electron in Al^{2+} is further from nucleus/more shielded/ stability of sub shell full Al^{3+}(higher energy level) 2 from 3 [2] 15

15	**(a)**	**(i)**	The ability/power of an atom to attract bonding electrons towards itself in a covalent bond	[2]	
		(ii)	decreases [1] Shared pair is further from nucleus [1] more shielded [1]	[3]	
	(b)	**(i)**	+6 [1] to +4 [1]	[2]	
		(ii)	$2Br^- \rightarrow Br_2 + 2e^-$	[2]	
		(iii)	$H_2SO_4 + \mathbf{2}H^+ + \mathbf{2e^-} \rightarrow SO_2 + \mathbf{2}H_2O$	[1]	
		(iv)	$H_2SO_4 + 2H^+ + 2Br^- \rightarrow SO_2 + 2H_2O + Br_2$	[1]	
		(v)	red-brown gas	[1]	
		(vi)	reducing agent	[1]	
		(vii)	chloride ions are not strong enough reducing agents to reduce concentrated sulphuric acid	[1]	
		(viii)	$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$	[2]	
	(c)	**(i)**	cream [1] precipitate [1]	[2]	
		(ii)	$Ag^+ (aq) + Br^- (aq) \rightarrow AgBr (s)$ Equation [1] State symbols [1]	[2]	
		(iii)	cream precipitate dissolves	[1]	21
				Section B	**80**
				Total	**100**

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2010

Chemistry

Assessment Unit AS 2

assessing

Module 2: Further Organic, Physical and Inorganic Chemistry and Introduction to Organic Chemistry

[AC121]

THURSDAY 21 JANUARY, AFTERNOON

MARK SCHEME

		AVAILABLE MARKS

Section A

1 A

2 C

3 C

4 C

5 D

6 D

7 A

8 C

9 C

10 D

[2] marks for each correct answer [20] 20

Section A **20**

ABLE

Section B

11 **(a)** CH_3CH_2Cl
CH_3CH_2ONa
CH_3CH_2Cl
CH_3CH_2Br [4] 4

12 **(a)** **(i)** molecule broken down (into a smaller molecule) [1]
using heat (and a catalyst) [1]

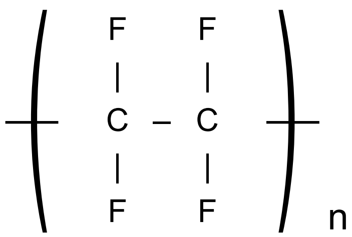
(ii) endothermic as ΔH is +ve [1]

(iii) low pressure [1]
more molecules on RHS [1]
but reaction rate is (slightly) slower [1]

(iv) high temperature
reaction is endothermic/ absorbs heat → RHS
and rate is increased [3]

(v) conc ammonia (solution) [1]
white smoke/fumes [1]

(b) **(i)**



[2]

(ii) contains a double bond/ C = C/ unsaturated [1]

(iii) addition [1] 15

13 **(a)** C_nH_{2n+2} [1]

(b) same molecular formula [1]
different arrangement of atoms etc [1]

(c) fractional distillation [2]

(d) 2 – methylbutane or methylbutane [1]
2, 2 – dimethylpropane or dimethylpropane [1]

(e) van der Waals forces greatest between chains
more branched lower b.pt [2]

(f) **(i)** $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ [2]

(ii) $2C_5H_{12} + 11O_2 \rightarrow 10CO + 12H_2O$ [2]

(g) **(i)**

$$\left.\begin{array}{llll} Cl & \frac{60.7}{35.5} = 1.71 & 1 & \\ C & \frac{34.2}{12} = 2.85 & 1.66 & 1\frac{2}{3} = \frac{5}{3} \\ H & \frac{5.1}{1} = 5.1 & 3 & \end{array}\right\} [1]$$

$1 : \frac{5}{3} : 3$

$\therefore\ 3 : 5 : 9$

$C_5H_9Cl_3$ or $Cl_3C_5H_9$ [3]

(ii) has a higher b.pt. because chloropentane has a greater mass than pentane/ polar /more van der Waals [1] 17

14 **(a)** more stable than ($BeCO_3$), $MgCO_3$ [1]

less stable than $SrCO_3$/ $BaCO_3$ [1]

(b) the size of cation increases down Gp = Group passim [1]
charge density decreases down Gp
polarisation power decreases down Gp [2]
max of 2

(c) produces CO_2 $CaCO_3 \rightarrow CaO + CO_2$ [1]
and CO_2 from combustion of fossil fuels [1]

(d) **(i)** $CaO + 2HCl \rightarrow CaCl_2 + H_2O$ [2]

(ii) $CaO + H_2O \rightarrow Ca(OH)_2$ [1]

(e) add $Ca(OH)_2$ to water
stir / until no more dissolves
filter
blow CO_2 through limewater/collect CO_2 in pipette/
add to container of CO_2 seal and shake
goes milky/chalky/cloudy [4]
max of 4
QWC [2]

(f) $Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$ [2]

(g) 100g of $CaCO_3$

$\frac{0.05}{100} = 5 \times 10^{-4}$ mol of $CaCO_3$

5×10^{-4} mol CO_2

$5 \times 10^{-4} \times 24 \text{ dm}^3 = 0.012 \text{ dm}^3$

$\% \, CO_2 = \frac{0.012}{5} \times 100 = 0.24\%$ [5] 22

15	**(a)**	**(i)**	$C_2H_4 + H_2O \rightarrow C_2H_5OH$	[1]
			steam/ high temp	[1]
			H_3PO_4	[1]
		(ii)	fermentation	[1]
			sugars	[1]

(b)

acidified dichromate		Iodine	[1]
warm	**or**	alkali	[1]
(orange) → green		yellow solid	[1]

(c)

bonds broken	5C—H	= 5 × 413	= 2065
	1C—C	= 1 × 347	= 347
	1C—O	= 1 × 360	= 360
	1O—H	= 1 × 464	= 464
	3O=O	= 3 × 498	= 1494
bonds formed	4C=O	= 4 × 805	= 3220
	6O—H	= 6 × 464	= 2784

bonds broken = +4730
bonds formed = –6004

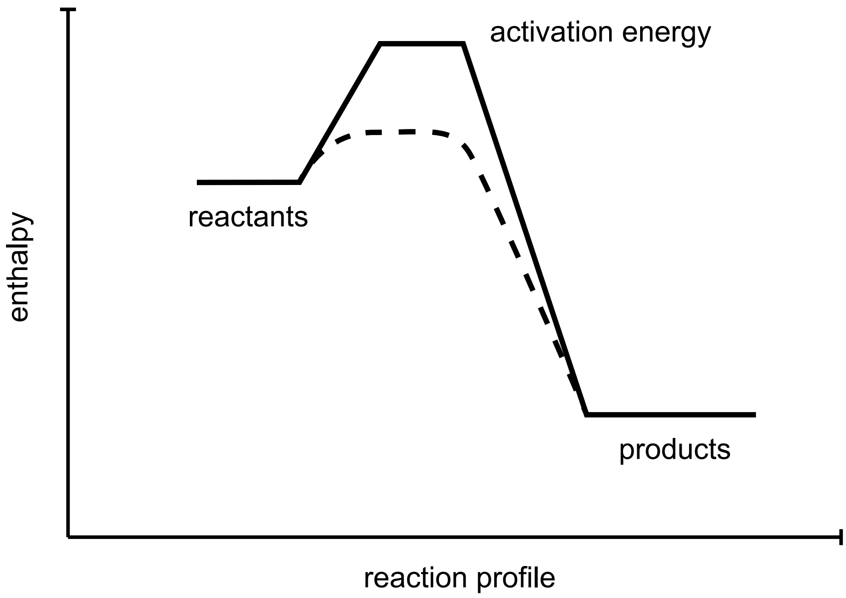
$\Delta H = -1274 \text{ kJ mol}^{-1}$ [4]

(d) (i) $CO \rightarrow CO_2$ [1]

$CxHy \rightarrow CO_2 + H_2O$ [1]

$NO_x \rightarrow N_2\ (+CO_2)$ [1]

(ii) lead [1]
covers the surface [1]
molecules prevented from chemisorption/ catalyst effect reduced [1]



activation energy lowered by the catalyst [4] 22

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