Published Mark Schemes for GCE AS Chemistry

Summer 2010

Issued: October 2010

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.

CONTENTS

	Page
AS 1: Module 1	
AS 2: Module 2	9
AS 3: Module 3 – Practical Examination 1	19
AS 3: Module 3 – Practical Examination 2	27

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Chemistry

Assessment Unit AS 1

assessing

Basic Concepts in Physical and Inorganic Chemistry

[AC111]

MONDAY 7 JUNE, MORNING

MARK SCHEME

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

Section B

11 **(a)** 14 [1]

(b) **(i)** $Al\ (g) \rightarrow Al^{+}\ (g) + e^{-}$

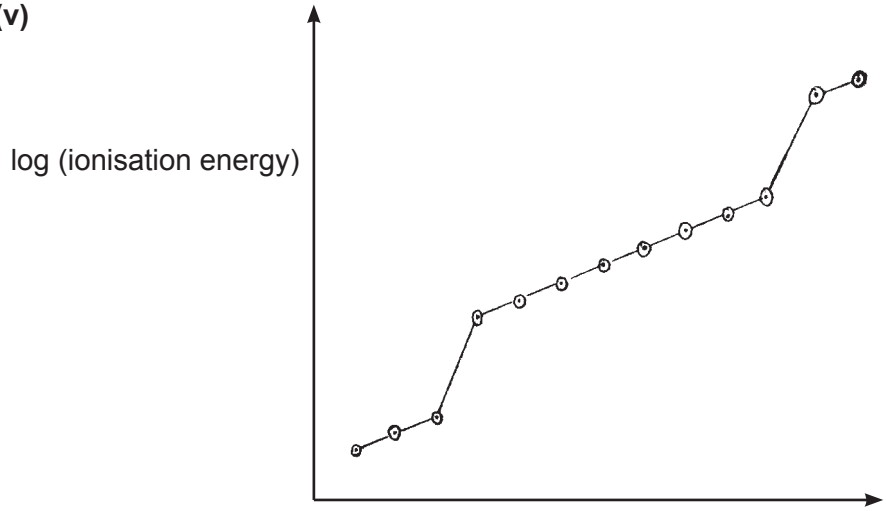
Equation [1] State symbols [1] [2]

(ii) Outer electron for boron is closer to nucleus [1]
and is less shielded [1] (than for aluminium) [2]

(iii) stability of filled 3s shell for magnesium [1]
aluminium has $3p^1$ configuration [1] [2]

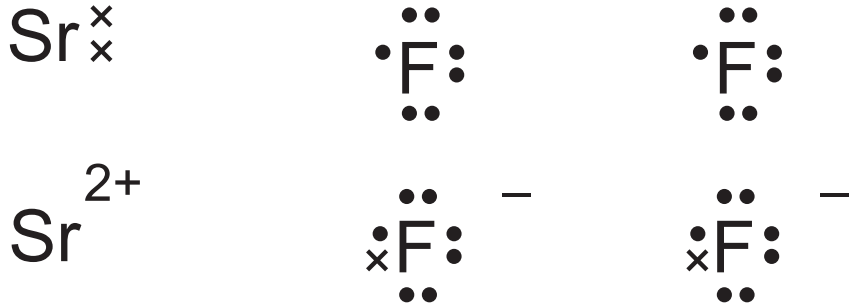
(iv) $1s^2 2s^2 2p^5$ [1]

(v)



[2] 10

12 (a) (i)

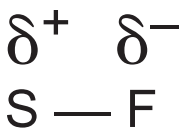


Sr atom [1]
F atom [1]
1 : 2 ratio [1]
correct electron transfer + charges [1]

(ii) solid strontium – good electrical conductor
solid strontium fluoride – poor electrical conductor } [1]
solid strontium – delocalised electrons [1]
solid strontium fluoride – ions are not free to move [1]

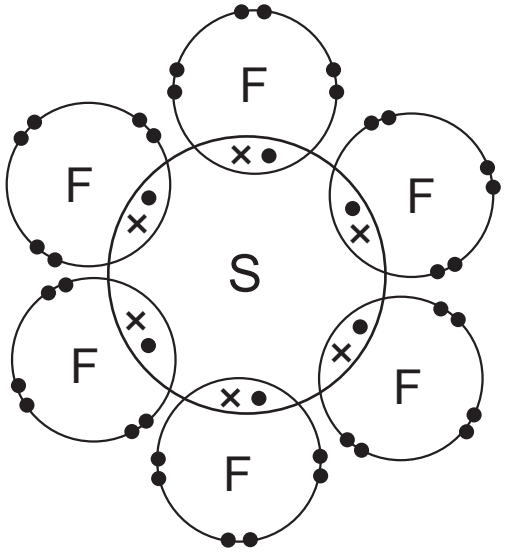
(b) (i) The ability/power of an atom to attract bonding electrons in a covalent bond [2]

(ii)



[1]

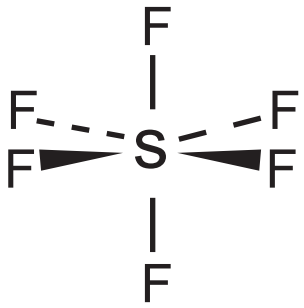
(iii)



[2]

(iv) does not apply to sulphur (12 electrons in outer shell) [1]
does apply to fluorine (8 electrons in outer shell)/octet rule – has 8 e^- in outer shell [1]

(v)



[1]

Octahedral [1]
(six) bonding pairs [1] repel equally [1] [2]

(vi) dipoles [1] cancel [1] [2]

(c) **(i)** coordinate/dative (covalent) bond [1]

(ii) both shared electrons come from nitrogen/lone pair of electrons on nitrogen shared (donated) [1] 22

13 **(a)** **(i)** loss of electrons [1]

(ii) decrease in oxidation state/number [1]

(b) **(i)** +5 [1]

(ii) +2 [1]

(c) **(i)** $2I^- \rightarrow I_2 + 2e^-$ [1]

(ii) $2HNO_3 + 6H^+ + 6I^- \rightarrow 2NO + 4H_2O + 3I_2$ [2]

(d) reference to **covalent bonding/crystalline**
molecular covalent **structure/diatomic/I_2**
van der Waals' attractions between molecules
1 mark for each two bold points mentioned – Max [3] marks

more soluble in hexane than water [1]
since iodine and hexane are non-polar [1] and water is polar [1]
like dissolves like [1]
Max [4] marks Max [5] marks

Quality of written communication [2] 14

14	**(a)**	**(i)**	$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$	[2]	
		(ii)	simultaneous reduction and oxidation [1] of the same element/in the same reaction [1]	[2]	
	(b)	**(i)**	$H_2 + Cl_2 \rightarrow 2HCl$	[2]	
		(ii)	HF – hydrogen bonding/polar HCl – polar/less polar than HF Greater energy needed to separate molecules	[1] [1] [1]	
		(iii)	H−Cl bond stronger than H−I bond does not break as easily when heated	[1] [1]	
	(c)	**(i)**	white [1] precipitate [1]	[2]	
		(ii)	$Ag^+ (aq) + Cl^- (aq) \rightarrow AgCl (s)$ Equation [1] State symbols [1]	 [2]	
		(iii)	(white) precipitate dissolves	[1]	16

15	**(a)**	**(i)**	contains no water (of crystallisation)	[1]	
		(ii)	0.0375	[1]	
		(iii)	6.07g	[1]	
		(iv)	0.337	[1]	
		(v)	9	[1]	
	(b)	**(i)**	solution of known concentration	[1]	
		(ii)	$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$	[2]	
		(iii)	methyl orange	[1]	
	(c)	**(i)**	yellow/orange [1] red/pink [1]	[2]	
		(ii)	0.00285	[1]	
		(iii)	0.001425	[1]	
		(iv)	0.01425	[1]	
		(v)	1.5105	[1]	
		(vi)	2.06	[1]	
		(vii)	0.1144	[1]	
		(viii)	8	[1]	18
				Section B	**80**
				Total	**100**

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Chemistry

Assessment Unit AS 2

assessing

Module 2: Organic, Physical and Inorganic Chemistry

[AC121]

THURSDAY 17 JUNE, AFTERNOON

MARK SCHEME

Section A

1 D

2 D

3 D

4 B

5 B

6 C

7 B

8 D

9 C

10 A

[2] for each correct answer [20] 20

Section A **20**

Section B

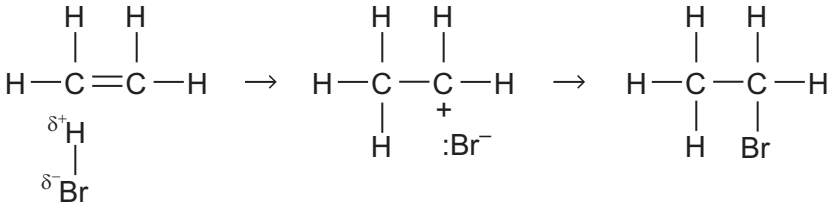
11

Element	Moles	Ratio
C	22.2 ÷ 12 = 1.85	2
H	3.7 ÷ 1 = 3.70	4
Br	74.1 ÷ 80 = 0.93	1

Moles [1]
Empirical Formula = C_2H_4Br [1]
216 ÷ 108 = 2 Molecular Formula = $C_4H_8Br_2$ [1] 3

12 (a) (i) Electrophilic [1] addition [1] [2]

(ii)



Dipole/H in HBr approaches the C═C [1]
Structure of carbocation intermediate [1]
bromide ion(Br^-) [1]

(b) (i) esterification [1]

(ii) ethanoyl chloride [1]

(iii) A = Ethanoic acid [1]
B = Ethyl ethanoate [1] 9
C = Ethanol

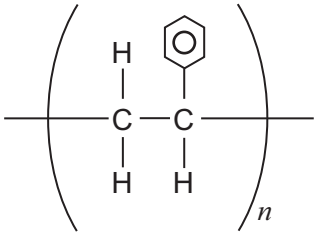
13 **(a)** **(i)** Either: $C_{17}H_{36} + 17\frac{1}{2}O_2 \rightarrow 17CO + 18H_2O$
Or: $2C_{17}H_{36} + 35O_2 \rightarrow 34CO + 36H_2O$ [2]

(ii) catalytic converter [1]

(b) Either: $C_{17}H_{36} \rightarrow 2C_2H_4 + C_3H_6 + C_{10}H_{22}$
Or: $C_{17}H_{36} \rightarrow 4C_2H_4 + 2C_3H_6 + C_3H_8$ [2]

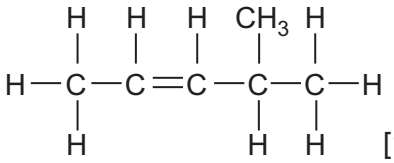
(c) **(i)** addition [1] polymerisation [1] [2]

(ii)



[1]

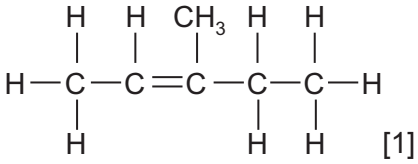
(d) **(i)** Either:



[1]

4-methylpent-2-ene [1]

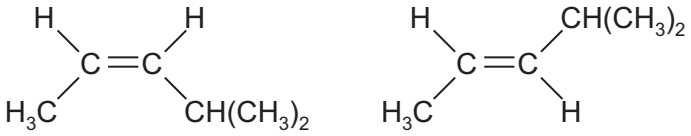
Or:



[1]

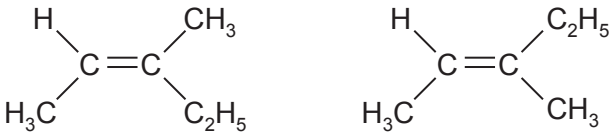
3-methylpent-2-ene [1] [2]

(ii) Either:



Distinction between *cis* and *trans* not necessary

Or:



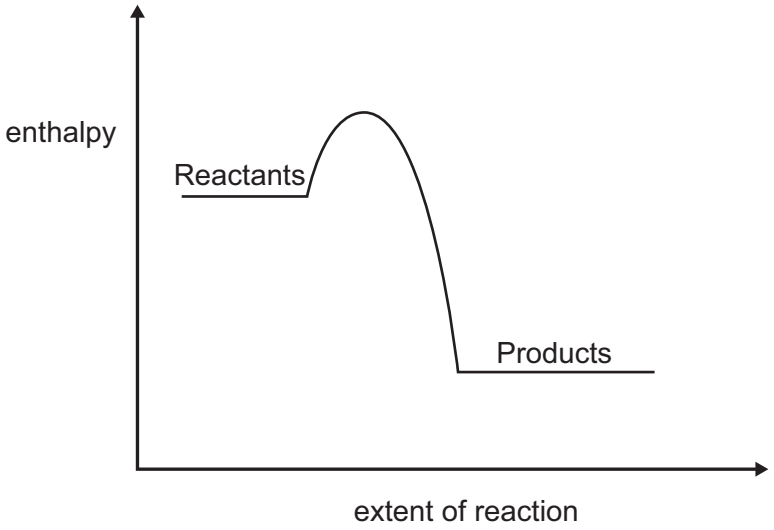
Distinction between *E* and *Z* not necessary [2] 12

14 **(a)** **(i)** Enthalpy change(s) [1]
is/are independent of the route taken [1]

(ii) Enthalpy change which occurs when 1 mole of a substance undergoes complete combustion in oxygen under standard conditions. [2]

(iii) $(-394) + (-286 \times 2) + (+75)$ [1]
$-891\ kJ\ mol^{-1}$ [1]

(b) **(i)**



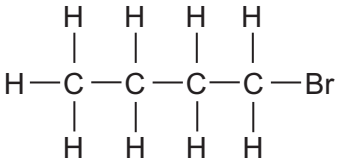
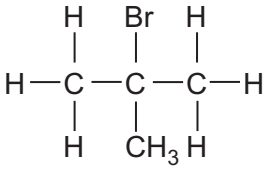
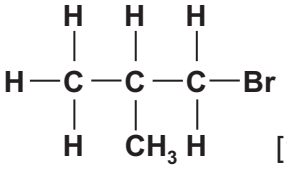
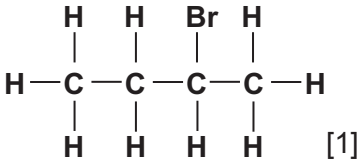
[1]

(ii) Energy required to break one mole of a given bond averaged over many compounds. Error [–1] [2]

(iii) $-698 = 4(C—H) - 2346$
$4(C—H) = 1648$
$412\ kJ\ mol^{-1}$ [3] 12

15	**(a)**	Rate of forward reaction = Rate of reverse reaction	[1]	
		The amount of any given reactant or product remains constant	[1]	
	(b)	Increase	[1]	
		3 moles (g) LHS 2 moles (g) RHS		
		Equilibrium shifts to RHS to oppose the change	[1]	
	(c)	Decrease	[1]	
		(Forward) reaction is exothermic		
		Equilibrium shifts to LHS to oppose the change/cool the system	[1]	
	(d)	No effect on yield	[1]	
		Increases the rate of the forward and reverse reactions equally	[1]	
	(e)	**(i)** 400–500 °C [1] 200–300 atm [1]	[2]	
		(ii) Compromise between rate and yield [1]	[1]	11

16 (a)

Structure and Name	Classification
 1-bromobutane	P
 2-bromo-2-methylpropane	**T** [1]
 [1] 1-bromo-2-methylpropane	**P** [1]
 [1] **2-bromobutane** [1]	**S** [1]

[6]

(b) **(i)** Distil and collect the 1-bromobutane at its boiling point [1]
Shake crude product with a solution of sodium carbonate in a separating funnel [1]
Release pressure [1]
Separate the organic layer [1]
Shake with a drying agent, e.g. anhydrous calcium chloride [1]
Filter [1]
(max = [4])

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.

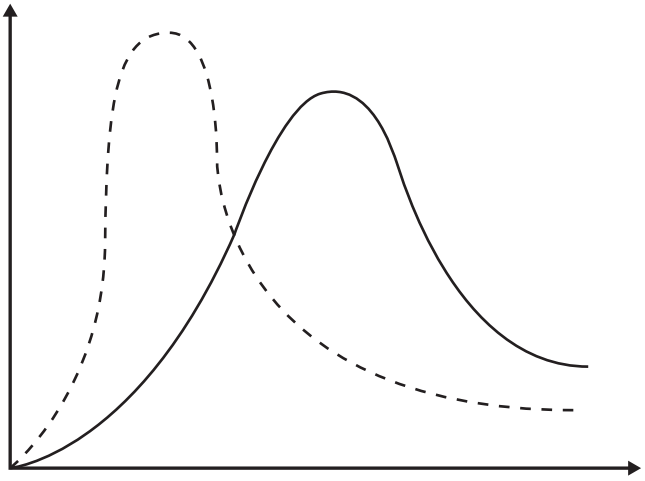
1 mark The candidate expresses ideas clearly, if not always fluently Arguments may sometimes stray from the point. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.

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.

Quality of written communication [2]

(ii) 11.10 ÷ 74 = 0.15 moles of butan-1-ol [1]
12.33 ÷ 137 = 0.09 moles of 1-bromobutane [1]
(0.09 ÷ 0.15) × 100 = 60% [1]

(c) Add an aqueous solution of silver nitrate [1]
A cream precipitate forms [1] 17

17	**(a)**	**(i)**	*y* axis = number of molecules *x* axis = (kinetic) energy	[1] [1]	
		(ii)	Either: all molecules have some energy/are moving Or: no molecules have zero (kinetic) energy	[1]	
		(iii)			
			maximum to LHS of original and higher lower number of molecules at higher energies	[1] [1]	
		(iv)	Number of molecules with energy greater than the activation energy decreases as temperature drops	[2]	
	(b)	**(i)**	vanadium(V) oxide	[1]	
		(ii)	nickel	[1]	
		(iii)	iron	[1]	
		(iv)	phosphoric acid	[1]	
	(c)	**(i)**	provides an alternative pathway with lower activation energy	[1] [1]	
		(ii)	moles of hydrogen peroxide = $2 \times 0.05 = 0.1$ mole 2:1 ratio so moles of oxygen = 0.05 Volume (dm^3) = $0.05 \times 24 = 1.2\ dm^3$ ($1200\ cm^3$)	[1] [1] [1]	16
				Section B	**80**
				Total	**100**

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

[AC131]

FRIDAY 14 MAY, MORNING

MARK SCHEME

CHEMISTRY

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

Annotation

1. Please do all marking in red ink.
2. All scripts are checked for mathematical errors. Please adopt the system of one tick (✓) equals [1] mark e.g. if you have awarded 4 marks for part of a question then 4 ticks (✓) should be on this candidate's answer.
3. As candidates have access to scripts please do not write any inappropriate comments on their scripts.

Mark Scheme

Section A

1 **(a)** Rinse the pipette with oven cleaner [1]
Pipette 25cm^3 of the oven cleaner into the 500cm^3 volumetric flask and make up to mark using distilled water [1]
(Stopper and) shake the flask/invert [1]
Using a pipette filler [1]
Rinse the pipette with the diluted solution and transfer 25cm^3 conical flask [1]
(1 mark each to a maximum of four) [4]

(b) Table [1]
Significant figures [2]
Calculation of the average titre [2]
Titration consistency [3]
Agreement with supervisor's titre [4] [12]

NOTES

Table:
Table should include initial burette reading, final burette reading, and volume delivered. The average titre should be calculated and the units included. Units missing (-1)

Significant figures:
All burette readings should be to at least one decimal place – each mistake is penalised by 1 mark.
(However initial burette readings of 0 are penalised once only.)
If used, the second decimal place position should be 0 or 5 only – other values will be penalised by 1 mark.

Average titre
Accurate titrations only should be used.
The use of a rough value is (-1).
The average value can be two decimal places, e.g. 25.37
An incorrect calculation is 0.
Mark denied if:
(i) only one accurate titration done
(ii) if titre not calculated correctly

Titration consistency

This is the difference between the first and second accurate readings

Difference	Mark
±0.1	[3]
±0.2	[2]
±0.3	[1]
±0.4	[4]

Titration agreement with the supervisor

Difference	Mark
±0.1	[4]
±0.2	[3]
±0.3	[2]
±0.4	[1]
±0.5	[0]

Please note that the supervisor's titre should be recorded at the bottom of page 3 in the candidate's script in RED INK.
The marks for table, significant figures etc should be recorded on the left-hand side of the candidate's table of results.

(c) yellow to orange/red [1]

(d) $NaOH + HCl \longrightarrow NaCl + H_2O$ [1]

(e) **(i)** Correct calculation using average titre i.e. $\frac{\text{titre} \times 0.1}{1000}$ [1]

(ii) Use of 1:1 ratio [1]

(iii) Moles of sodium hydroxide in 500cm^3 of diluted oven cleaner (×20) [1]

(iv) Moles of sodium hydroxide in 25cm^3 of undiluted oven cleaner (same value as **(iii)**) [1]

(v) Concentration of sodium hydroxide in oven cleaner (mol dm^{-3}) (×40) [1]

(vi) Concentration in g dm^{-3} (× 40) [1]

(vii) (gdm^{-3}/1000) (× 100) [1]

In part **(e)**, carry error through (c.e.t.) if appropriate. 25

2 Observation and deduction

Safety glasses should be worn at all times and care should be taken during this practical examination.

(a) You are provided with a mixture of two salts, labelled A, which have a common cation.
Carry out the following experiments on the mixture.
Record your observations and deductions in the spaces below and identify the two salts.

Please note that the total marks for each box should be written in the box and not in the examiner's column.

Experiment	Observations	Deductions
1) Make a solution of A by dissolving a spatula of A in a test tube half-full of water. Warm gently. Transfer 1cm^3 of the solution into each of two separate test tubes. (a) Add a few drops of sodium hydroxide solution to the first test tube. Then add a further 3cm^3 of the sodium hydroxide solution to the test tube. (b) Add a few drops of ammonia solution to the second test tube. Then add a further 3cm^3 of the ammonia solution to the test tube.	*Colourless solution [1]* *White precipitate [1]* *Insoluble in excess [1]* *White precipitate [1]* *Insoluble in excess [1]* [5]	*Possibly magnesium, Zinc or Aluminium ion [1]* *Possibly magnesium / ion or compounds [1]* *Confirms the presence of magnesium ion or compounds [1]* [3]
2) Make a solution of A by dissolving half a spatula – measure of A in a test tube half – full of nitric acid solution. Warm gently. Transfer 1cm^3 of the solution into each of two separate test tubes. (a) (i) Add a few drops of silver nitrate solution to the first test tube. (ii) Then add about 2cm^3 of dilute ammonia solution to the same test tube. (b) Add a few drops of barium chloride solution to the second test tube.	*No effervescence [1]* *White precipitate [1]* *Precipitate dissolves [1]* *White precipitate [1]* [4]	*Not a carbonate/hydrogen carbonate [1]* *Possibly chloride ion [1]* *Chloride ion present [1]* *Sulphate ion present [1]* [4]

Name the two salts present in A:

Magnesium chloride [1]

Magnesium sulphate [1]

An incorrect deduction can be carried through to naming the salts.
A deduction based on an incorrect observation can be credited on the basis of carry error through (c.e.t.).
In **2 (a) (i)** and **(ii)** mark denied if 'chlorine' is given.

(b) You are provided with an organic liquid labelled B. Carry out the following exp[illegible] the liquid. Record your observations and deductions in the spaces below.

Experiment	Observations	Deduction
1) Place 10 drops of B in a test tube and add 1cm^3 of water.	*Forms one layer/mixes completely/dissolves/ colourless solution [1]* [1]	*Soluble/miscible with water [1]* *Forms H-bonds with water [1]* [2]
2) Place 10 drops of B on a watch glass placed on a heat proof mat and ignite it using a splint.	*Yellow/blue flame [1]* *Clean flame/little or no smoke [1]* [2]	*Low carbon content/saturated compound/C:H low/short chain/contains oxygen [1]* [1]
3) Add approximately 10 drops of B to a test tube one quarter full of bromine water and mix well.	*Yellow/orange colour remains [1]* [1]	*Alkene present/Saturated/ no C=C bonds present [1]* [1]
4) Add ten drops of B to 2cm^3 of acidified potassium dichromate solution in a test tube. Warm the mixture gently.	*Orange to green [1]* *Change of smell [1]* [2]	*Primary or secondary alcohol / Not a tertiary alcohol [1]* *Can be oxidised/reducing agent / aldehyde or ketone formed [1]* [2]

Based on the tests above, suggest:

a functional group which may be present in B.

-OH [1]

a functional group which is absent in B.

C=C [1]

Mark to a maximum of 29 marks for question 2

N.B. Liquid is ethanol

AVAILABLE MARKS
29

Section A Total **54**

Section B

3 **(a)** **(i)** Mass of the container
Mass of the container + lead oxide [2]

(ii) Carry out in a fume cupboard/use gloves/tongs/allow to cool [1]
Carbon monoxide is poisonous/apparatus is hot [1] [2]

(iii) Heat and reweigh [1] until the mass is constant [1] [2]

(iv) Prevents reoxidising the lead/stops air re-entering [1]
Allows the metal to cool/apparatus still hot [1] [2]

(b) **(i)** 1.39-1.26 = 0.13g [1]

(ii) $0.13/16 = 8.125 \times 10^{-3}$ [1]

(iii) $1.26/207 = 6.087 \times 10^{-3}$ [1]

(iv) $Pb:O = 6.087 \times 10^{-3} : 8.125 \times 10^{-3}$
Pb:O = 3:4
Pb_3O_4
(-1 for each mistake) [2]

(c) **(i)** $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$ [2]

(ii) $2PbO + C \rightarrow 2Pb + CO_2$ [1]

(iii) 20.32/100 × 8.5 = 1.73g
207/239 × 100 = 86.61%
1.73/100 × 86.61 = 1.50g
1.500/20.32 × 100 = 7.38% [4] 20

In parts **(b)** and **(c)**, carry error through if appropriate.

4 **(a)** Repeated boiling and condensing of a reaction mixture without loss of reactants [1]

(b) **(i)** Place sample in a separating funnel
Add sodium hydrogencarbonate / carbonate solution and shake [2]

(ii) Add suitable named anhydrous solid to the sample [1]
Filter/decant [1] [2]

(iii) Distil the sample
Collect the sample boiling between 210 - 212°C [2] 7

5	**(a)**	Dip nichrome wire/silica rod into concentrated hydrochloric acid and then into the solid [1] Heat in a blue Bunsen flame [1] Orange/yellow flame indicates the presence of sodium [1] [3]	
	(b)	Add dilute hydrochloric acid to the solid [1] Bubble the gas given off through limewater [1] If the limewater turns milky/cloudy then carbonate/hydrogencarbonate ions are present [1] [3]	
	(c)	Make a solution of the solid [1] Add a solution of magnesium ions [1] A white precipitate indicates a carbonate, no precipitate indicates a hydrogencarbonate [1] [3]	9
		Section B Total	**36**
		Paper Total	**90**

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2010

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 2

[AC132]

TUESDAY 18 MAY, AFTERNOON

MARK SCHEME

CHEMISTRY

Assessment Unit AS 3

assessing

Module 3: Practical Examination 2

Mark Scheme

Annotation

1. Please do all marking in red ink.
2. All scripts are checked for mathematical errors. Please adopt the system of one tick (✓) equals [1] mark e.g. if you have awarded 4 marks for part of a question then 4 ticks (✓) should be on this candidate's answer.
3. As candidates have access to scripts please do not write any inappropriate comments on their scripts.

Section A

1 **(a)** Rinse the pipette with distilled water and then drain cleaner [1]
Pipette 25cm^3 of the oven cleaner into the 500cm^3 volumetric flask and make up to mark using distilled water [1]
(Stopper and) shake the flask/invert [1]
Using a pipette filler [1]
Rinse the pipette with the diluted solution and transfer 25cm^3 conical flask [1]
(1 mark each to a maximum of four) [4]

(b) Table [1]
Significant figures [2]
Calculation of the average titre [2]
Titration consistency [3]
Agreement with supervisor's titre [4] [12]

NOTES

Table:
Table should include initial burette reading, final burette reading, and volume delivered. The average titre should be calculated and the units included. Units missing (-1).

Significant figures:
All burette readings should be to at least one decimal place – each mistake is penalised by 1 mark.
(However initial burette readings of 0 are penalised once only.)
If used, the second decimal place position should be 0 or 5 only – other values will be penalised by 1 mark.

Average titre
Accurate titrations only should be used.
The use of a rough value is (-1).
The average value can be two decimal places, e.g. 25.37
An incorrect calculation is 0.
Mark denied if:
(i) only one accurate titration done
(ii) if titre not calculated correctly

Titration consistency

This is the difference between the first and second accurate readings

Difference	Mark
±0.1	[3]
±0.2	[2]
±0.3	[1]
±0.4	[0]

Titration agreement with the supervisor

Difference	Mark
±0.1	[4]
±0.2	[3]
±0.3	[2]
±0.4	[1]
±0.5	[0]

Please note that the supervisor's titre should be recorded at the bottom of page 3 in the candidate's script in RED INK.
The marks for table, significant figures etc should be recorded on the left-hand side of the candidate's table of results.

(c) yellow to orange/red [1]

(d) $KOH + HCl \longrightarrow KCl + H_2O$ [1]

(e) **(i)** Correct calculation using average titre i.e. $\frac{\text{titre} \times 0.1}{1000}$ [1]

(ii) Use of 1:1 ratio [1]

(iii) Moles of potassium hydroxide 500cm^3 of diluted drain cleaner (×20) [1]

(iv) Moles of potassium hydroxide in 25cm^3 of undiluted drain cleaner (same value as **(iii)**) [1]

(v) Concentration of potassium hydroxide in drain cleaner (mol dm^{-3}) (×40) [1]

(vi) Concentration in mol dm^{-3} (× 56) [1]

(vii) (gdm^{-3}/1000) × 100 [1]

In part **(e)**, carry error through (c.e.t.) if appropriate. 25

2 Observation and deduction

Safety glasses should be worn at all times and care should be taken during this practical examination.

(a) You are provided with a mixture of two salts, labelled X, which have a common cation. Carry out the following experiments on the mixture.
Record your observations and deductions in the spaces below and identify the two salts.

Please note that the total marks for each box should be written in the box and not in the examiner's column.

Experiment	Observations	Deductions
1) Make a solution of X by dissolving half a spatula-measure of X in a test tube half-full of water. Transfer 1cm^3 of this solution into each of two separate test tubes.	*Colourless solution [1]*	
(a) Add a few drops of sodium hydroxide solution to the first test tube. Then add a further 10cm^3 of the sodium hydroxide solution to the test tube.	*White precipitate [1]* *soluble in excess [1]*	*Possibly Magnesium, Zinc or Aluminium ion [1]* *Possibly zinc or aluminium ion or compounds [1]*
(b) Add a few drops and of ammonia solution to the second test tube. Then add a further 5cm^3 of the ammonia solution to the test tube.	*White precipitate [1]* *soluble in excess [1]* [5]	*Confirms the presence of zinc ion or compounds [1]* [3]
2) Make a solution of X by dissolving half a spatula-measure of X in a test tube half-full of nitric acid solution. Transfer 1cm^3 of this solution into each of two separate test tubes.	*No effervescence [1]*	*Not a carbonate/hydrogen carbonate [1]*
(a) (i) Add a few drops of silver nitrate solution to the first test tube.	*White precipitate [1]*	*Possibly chloride ions [1]*
(ii) Then add about 5cm^3 of dilute ammonia solution to the same test tube.	*Precipitate dissolves [1]*	*Chloride ion present [1]*
(b) Add a few drops of barium chloride solution to the second test tube.	*White precipitate [1]* [4]	*Sulphate ion present [1]* [4]

Name the two salts present in X:

Zinc chloride [1]

Zinc sulphate [1]

An incorrect deduction can be carried through to naming the salts.
A deduction based on an incorrect observation can be credited on the basis of carry error through (c.e.t.).
In **2 (a) (i)** and **(ii)** mark denied if 'chlorine' is given.

(b) You are provided with an organic liquid labelled Y. Carry out the following exp[illegible] the liquid. Record your observations and deductions in the spaces below.

Experiment	Observations	Deduction
1) Place 10 drops of Y in a test tube and add 1cm^3 of water.	*Immiscible/2 layers [1]* [1]	*No H-bonds/No -OH present/non-polar [1]* *Less dense than water [1]* [2]
2) Place 10 drops of Y on a watch glass placed on a heat proof mat and ignite it using a splint.	*Smoky [1]* *Yellow flame [1]* [2]	*Unsaturated/high carbon content [1]* [1]
3) Add approximately 10 drops of Y to a test tube one quarter full of bromine water and mix well.	*Yellow/orange/brown [1]* *Turns colourless [1]* [2]	*Alkene present/ Unsaturated/C=C bonds present [1]* [1]
4) Add 10 drops of Y to 2cm^3 of acidified potassium dichromate solution in a test tube. Warm the mixture gently.	*Remains orange /no change [1]* [1]	*Possibly a tertiary alcohol/ Not a primary or secondary alcohol [1]* *Not reducing agent/not oxidation [1]* [2]

Based on the tests above, suggest:

AVAILABLE MARKS

a functional group which may be present in Y.

C=C [1]

a functional group which is absent in Y.

-OH [1]

Mark to a maximum of 29 marks for question 2 29

N.B. The Liquid is turpentine

Section A Total **54**

Section B

3 **(a)** **(i)** Mass of the container
Mass of the container + copper oxide [2]

(ii) Flush out the apparatus with hydrogen/use gloves/tongs/allow to cool [1]
Hydrogen – air mixture is explosive/apparatus is hot [1] [2]

(iii) Heat and reweigh [1] until the mass is constant [1] [2]

(iv) Prevents reoxidising the copper/stops air re-entering [1]
Allows the metal to cool/apparatus still hot [1] [2]

(b) **(i)** 2.16 – 1.92 = 0.24g [1]

(ii) 0.24/16 = 0.015 [1]

(iii) 1.92/64 = 0.030 [1]

(iv) Cu:O = 0.030:0.015
Cu:O = 2:l
Cu_2O
(-1 for each mistake) [2]

(c) **(i)** $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$ [2]

(ii) $2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$ [1]

(iii) 25.86/100 × 34.8 = 8.999g
64/184 × 100 = 34.78%
8.999/100 × 34.78 = 3.130g
3.130/25.86 × 100 = 12.1% [4] 20

In parts **(b)** and **(c)**, carry error through if appropriate.

4 **(a)** Repeated boiling and condensing of a reaction mixture without loss of reactants [1]

(b) **(i)** Place sample in a separating funnel
Add sodium hydrogencarbonate / carbonate solution and shake [2]

(ii) Add suitable named anhydrous solid to the sample
Filter/decant [1] [2]

(iii) Distil the sample
Collect the sample boiling between 90 – 92°C [2] 7

5	**(a)**	Dip nichrome wire/silica rod into concentrated hydrochloric acid and then into the solid [1] Heat in a blue Bunsen flame [1] lilac flame indicates the presence of potassium [1] [3]	
	(b)	Add dilute nitric acid to solid followed by silver nitrate solution [1] White precipitate shows chloride [1] Yellow precipitate shows iodide [1] [3]	
	(c)	Silver chloride is soluble in dilute and concentrated ammonia solution [1] forming a colourless solution [1] Silver iodide is insoluble in dilute and concentrated ammonia solution [1] [3]	9
		Section B Total	**36**
		Paper Total	**90**