Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2011

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

[AC131]

TUESDAY 10 MAY, MORNING

MARK SCHEME

AVAILABLE MARKS

Annotation

1. Please do all marking in red ink.
2. All scripts are checked for mathematical errors. Please adopt a 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)** Accuracy: Use/rinse pipette (with acid) [1]
Indicator just changes colour [1]
Read bottom of meniscus [1]
Approach end point dropwise [1]
Read burette to at least one decimal place [1]
Swirl/wash down sides of flask (with distilled water) [1]
Any three to a maximum of [3]

Reliability:

Repeat titrations [1]
To obtain readings which are consistent [1] [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 one 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 for each.

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

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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 – using candidate's average titre. If average titre calculated incorrectly the correct value should be determined and thus used to compare with teacher's value.

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) colourless to pink or red [1]

(d) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ [2]
Unbalanced with correct formula [1]
Incorrect formula/missing reactant or product [0]

(e) **(i)** Average titre $\times$ 0.1/1000 [1]

(ii) Number of moles NaOH above divided by 2 [1]

(iii) Answer to **(ii)** $\times$ 10 [1]

(iv) As for part **(iii)** [1]

(v) Concentration = Ans part **(iv)** $\times$ 1000 $\div$ 0.8 [1]

(vi) Ans part **(v)** $\times$ 98 [1]

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

2 (a) Observation and deduction

AVAILABLE MARKS

Experiment	Observations	Deductions
1 Describe X.	*White solid [1]*	*Not transition metal salt or could be Group 1 or 2/ ammonium salt [1]*
2 **(a)** Fill a test tube one quarter full of water and record the temperature. **(b)** Add three spatula measures of X to the test tube, stir and record the temperature. **(c)** Record the temperature change.	*Two values given/ Temperature drops/ falls [1]*	*Endothermic [1]*
3 **(a)** Add 1–2 cm^3 of the solution formed in experiment 2 above to another test tube. **(b)** Acidify with 1 cm^3 of dilute nitric acid and then add 1 cm^3 of silver nitrate solution. **(c)** Add 5 cm^3 of dilute ammonia solution to the test tube.	*No effervescence [1] (accept no fizzing or bubbles given off) can be credited in 4(b), but only if not given here* *White precipitate [1]* *Precipitate dissolves/ Colourless solution [1] (accept solid dissolves)*	*Not a carbonate/ hydrogencarbonate [1] can be credited in 4(b), but only if not given here* *Possibly chloride ions [1]* *Confirms chloride ions [1]*
4 **(a)** Add 1–2 cm^3 of the solution formed in part 2 above to another test tube. **(b)** Acidify with 3 drops of dilute nitric acid and then add 3 drops of barium chloride solution.	*White precipitate/ solid [1]*	*Sulphate ion present [1]*

	Experiment	Observations	Deductions
5	Add a spatula measure of X to a test tube one third full of dilute sodium hydroxide solution and warm gently, testing any gas evolved with moist universal indicator paper.	*Strong/pungent smell [1]* *paper turns blue [1]*	*Possibly ammonia gas [1]* *Gas is alkaline/ pH9 – 11 [1]* *Ammonium salt/ compounds [1]*

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Two salts present in X:

Ammonium chloride [1]

Ammonium 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.).

(b)

AVAILABLE MARKS

	Experiment	Observations	Deductions
1	Describe the smell of solution Y.	*Vinegar/sharp smell [1]*	*Carboxylic acid/ ethanoic acid [1] contains – COOH*
2	Using a glass rod place a drop of Y onto Universal Indicator paper.	*Yellow/orange/ red [1]*	*Acidic, pH1 – 4 [1] as above box*
3	Add a spatula measure of anhydrous sodium carbonate to a test tube one quarter full of solution Y and identify the gas evolved using a suitable reagent.	*Fizzing/ effervescence [1] Gas turns limewater milky [1] (accept bubbles given off for fizzing)*	*Acidic [1] Carbon dioxide [1]*
4	Add 1 cm^3 of Y to a test tube and then add a 2 cm length of magnesium ribbon.	*Effervescence/ fizzing [1] (accept bubbles given off for fizzing) Colourless solution Heat given off [1]*	*Acidic [1]* *Exothermic*

Carboxylate/COOH [1]/Carboxyl

$2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2$ [2]
(Formulae in equation correct but unbalanced [1])

Parts **(a)** and **(b)** to a maximum of [29] 29

Section B

AVAILABLE MARKS

3 (a) (i) Stop draughts/heat loss/not insulation [1]

(ii) Mass of (burner with) alcohol at start [1]
Mass of (burner with) alcohol at end [1]
Mass of water (used) [1] [3]

(iii) Amount of energy required to heat 1 g (of water) [1]
By one degree centigrade [1]/Celsius/Kelvin [2]

(b) (i) 0.35 g ethanol produces $4.18 \times 300 \times 5.5$ J $= 6897$ J
46 g (1 mole) produces $6897 \times 46/0.35$ J $= 906460$ J
Molar enthalpy of combustion -906460 J mol^{-1} or -906.46 kJ mol^{-1}
neg sign needed
units needed [3]

(ii) Loss of heat during experiment [1]
Incomplete combustion [1] [2]

(c) (i) $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ [2]
Formulae correct but unbalanced [1]

(ii)

Bonds broken	Bonds formed
$5 \times$ C–H $= 5 \times 413 = 2065$	$4 \times$ C=O $= 4 \times 740 = 2960$
C–O $= 360$	$6 \times$ O–H $= 6 \times 463 = 2778$
O–H $= 463$	
$3 \times$ O=O $= 3 \times 497 = 1491$	
C–C $= 346$	
Total $= +4725$	Total $= -5738$

Enthalpy $= -1013$ kJ mol^{-1} [3]

Each error [–1], carry error through.

(iii) One CH_2 group $= -2021 - (-1367) = -654$ [1]
$2 \times CH_2$ groups $= 2 \times -654 = -1308$
Pentan–1–ol $= -2021 + (-1308) = -3329$ kJ mol^{-1} [1]
Carry any error through error [–1] [2]

(iv) Carbon [1]
Carbon monoxide [1] [2]

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				AVAILABLE MARKS
4	(a)	dehydrating agent/removes water (**not** drying agent)/catalyst	[1]	
	(b) (i)	prevent evaporation/loss of product [1] fire risk [1]	[2]	
	(ii)	ethanol/ethane	[1]	
	(c) (i)	remove acidic impurities	[1]	
	(ii)	no hydrogen bonds/non-polar	[1]	
	(iii)	drying (not dehydrating) agent/removes water	[1]	
	(iv)	filtration/decant	[1]	
	(v)	(large) difference in boiling points	[1]	9
5	(a)	Both produce a white precipitate [1] (accept white solid) Aluminium: precipitate dissolves in excess (to give a colourless solution) [1] (accept solid dissolves) Magnesium: no change [1]	[3]	
	(b)	Iron(III): Add (potassium) thiocyanate (solution) [1] Blood red solution (penalise solid or precipitate) [1] Sodium: Flame test [1] Orange/yellow [1]	[4]	7
			Total	**90**