



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012**

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 2

[AC132]

TUESDAY 22 MAY, MORNING

MARK SCHEME

Annotation

1. Please do all marking in **red** ink.
2. All scripts should be checked for mathematical errors. Please adopt a system of one tick (✓) for 1 mark, e.g. if you have awarded 4 marks for part of a question then 4 ticks (✓) should be on the candidate's answer.
3. The total mark for each question should be recorded in a circle placed opposite the question number in the teacher mark column.
4. As candidates have access to scripts please do not write any inappropriate comments on their scripts.

General points

- All calculations are marked according to the number of errors made.
- Errors can be carried through. If the wrong calculation is carried out then the incorrect answer can be carried through. One mistake at the start of a question does not always mean that all marks are lost.
- Listing is when more than one answer is given for a question that only requires one answer, e.g. the precipitate from a chloride with silver nitrate is a white solid; if the candidate states a white or a cream solid, one answer is correct and one answer is wrong. Hence they cancel out.
- Although names might be in the mark scheme it is generally accepted that formulae can replace them. Formulae and names are often interchangeable in chemistry.
- The marking of colours is defined in the 'CCEA GCE Chemistry Acceptable Colours' document.

MARKING GUIDELINES

Interpretation of the Mark Scheme

- **Carry error through**
This is where mistakes/wrong answers are penalised when made, but if carried into further steps of the question, then no further penalty is applied. This pertains to calculations and observational/ deduction exercises. Please annotate candidates' answers by writing the letters c.e.t. on the appropriate place in the candidates' answers.
- **Oblique/forward slash**
This indicates an acceptable alternative answer(s).
- **Brackets**
Where an answer is given in the mark scheme and is followed by a word/words in brackets, this indicates that the information within the brackets is non-essential for awarding the mark(s).

Section A

- 1 (a) Density = 0.90 = 6.0/v therefore $v = 6.67 \text{ cm}^3$ [1]
 $6.67/4 = 1.67/1.6675 \text{ cm}^3$ for 250 cm^3 [1]

In marking the calculation a mark is lost for each error made. Not stating the units, i.e. cm^3 , would be an error. Carrying out the calculation 6.0×0.90 to give 5.4 is regarded as one error.

Dividing 6.0 by 0.90 gives 6.67. It has not been normal practice to penalise the number of decimal places hence 6.67 is acceptable. However, correct rounding off is required and 6.6 would be an error but 6.7 would be acceptable.

The volume required for 250 cm^3 is found by dividing by 4 and correct rounding is required.

Add calculated volume or mass of acid/measure in measuring cylinder or burette or graduated cylinder [1]

Wash into volumetric flask [1]

Make up to mark (with distilled water) [1]

Invert/shake the flask [1] [6]

(b) Table [3]

The Table should be drawn as a table. It should be labelled with the following: initial burette reading, final burette reading and the titre. It is not necessary to use exactly these words but there should be appropriate columns and rows [1]. Units, i.e. cm^3 , should be stated [1].

The rough titration value should not be the same as the accurate values [1].

Use of decimal places [2]

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 [2]

Accurate titrations only should be used. The use of a rough value is [-1].

The average value can be calculated to two decimal places or more, e.g. 25.15 and 25.20 average to 25.175.

If three accurate titres are recorded, then the average titre must be calculated using all three accurate titres.

Any error is [-1]. This might be an incorrect calculation or the omission of units. If the average titre is included in the table then the units indicated on the table apply.

Titration consistency [2]

This is the difference within the accurate titrations. If three accurate values are given then the difference between highest and lowest is used.

| Difference | Mark |
|------------|------|
| 0.1 | [2] |
| 0.2 | [1] |
| >0.2 | [0] |

Titration agreement [3]

The correct average titre is used. If the incorrect average has been calculated the correct one is calculated and used.

| | |
|------|-----|
| ±0.1 | [3] |
| ±0.2 | [2] |
| ±0.3 | [1] |
| >0.3 | [0] |

The difference should be rounded to one decimal place. Please note that the supervisor's titre should be recorded after the candidate's table on their script in **red** ink.

The marks for table, decimal places etc. should be recorded at the candidate's table of results.

[12]

| | | |
|---|-----|----|
| (c) colourless pink/red | [1] | |
| (d) $\text{RCOOH} + \text{NaOH} \rightarrow \text{RCOONa} + \text{H}_2\text{O}$ NB RCO_2H etc is acceptable | [1] | |
| (e) Volume expected = $V \text{ cm}^3$ therefore (volume \times molarity) acid = (volume \times molarity) alkali $25 \times M = V \times 0.1$ $M = V \times 0.1/25.0$ error [-1] Units not expected but penalise incorrect units | [2] | |
| (f) (i) $\text{RMM} = 6.0/M$ If the symbol g for grams is used with the RMM the mark is not awarded | [1] | |
| (ii) $\text{RCOOH} = R + 12 + 32 + 1 = R + 45 = \text{RMM}$ $R = \text{RMM} - 45$ If the symbol g is used again in part (ii) it is not penalised twice | [1] | |
| (iii) If $\text{RFM} \leq 22$ then $R = \text{CH}_3$ (CH_3COOH) If $\text{RFM} > 22$ then $R = \text{C}_2\text{H}_5$ ($\text{C}_2\text{H}_5\text{COOH}$) | [1] | 25 |

2 (a)

| Experiment | Observations | Deductions | |
|--|--|---|--|
| 1 Describe the appearance of each salt in the mixture. | <i>Green solid/powder [1]</i> | <i>Transition metal compound/copper ion present [1]</i> | |
| | <i>White powder [1]</i> | <i>Not a transition metal compound/contains Group I or II metal ion/ammonium compound [1]</i> | |
| 2 (a) Add two spatula measures of X to 30 cm ³ of distilled water and stir. Filter. | <i>Filtrate is colourless [1] residue is green [1]</i> | | |
| (b) Add five drops of dilute nitric acid to two cm ³ of the filtrate. | | | |
| (i) Add one cm ³ of silver nitrate solution to the acidified filtrate. | | <i>yellow precipitate [1]</i> | <i>Iodide ions present [1]</i> |
| (ii) In a fume cupboard add 10 cm ³ of concentrated ammonia solution. | | <i>precipitate does not dissolve [1]</i> | <i>(confirms) iodide ion present [1]</i> |
| (c) Dip a clean nichrome wire into concentrated hydrochloric acid and use it to place some of the filtrate into a blue Bunsen flame. | <i>orange/yellow [1]</i> | <i>sodium ion present [1]</i> | |

| | | | | |
|---|-----|--|---|---|
| 3 | (a) | Add three spatula measures of the mixture X to a test tube. Slowly add four cm ³ of dilute nitric acid. | <i>Effervescence/fizzing [1] Blue/blue-green/green solution [1]</i> | |
| | (b) | Test any gas given off with 5 cm ³ of limewater. | <i>limewater turns milky/cloudy [1]</i> | <i>Carbon dioxide gas given off [1] Therefore carbonate [1]</i> |
| | (c) | To the acidified solution of X , slowly add dilute ammonia solution dropwise. Continue to add dilute ammonia solution until no further change occurs. | <i>blue precipitate [1] dissolves [1] to give a (dark/deep) blue solution [1]</i> | <i>copper ions present [1]</i> |

Name the soluble salt in **X**:

_____ Sodium iodide [1]

Name the insoluble salt in **X**:

_____ Copper carbonate [1]

- (b) You are provided with a sample of an organic liquid, labelled **Y**. Carry out the following experiments. Record your observations and deductions in the spaces provided.

| | Experiment | Observations | Deductions |
|---|--|--|---|
| 1 | Add 5 cm ³ of Y to 5 cm ³ of water in a test tube. Add a bung to the test tube and shake the contents. Allow the mixture to settle. | <i>one layer [1]</i> | <i>Miscible/all dissolves/forms H-bonds/both polar [1]</i> |
| 2 | Add equal amounts of Y and potassium dichromate solution into a test tube. Acidify with dilute sulfuric acid and warm the mixture in a water bath. | <i>orange to green [1] change in smell [1]</i> | <i>primary/secondary alcohol/not tertiary alcohol/Y is oxidised/aldehyde/ketone formed/carboxylic acid [1]</i> |
| 3 | Place ten drops of Y on a watch-glass placed on a heatproof mat and ignite using a burning splint. | <i>clean/not smokey/ yellow/blue flame [1]</i> | <i>Low percentage carbon/ no C=C double bonds/ presence of oxygen in the molecule [1]</i> |

What is the functional group present in liquid **Y**?

_____ -OH/hydroxyl/hydroxy **Not** hydroxide/alcohol [1]

Max. 29

Section A

54

General:

An incorrect deduction can be carried through to naming the salts. A deduction based on an observation can be credited on the basis of c.e.t.

Wrong placing of answers

In the observational/deduction question candidates may write their answers in the wrong column. This is not penalised, e.g. a deduction written in the observation column may be credited, if correct.

Further observations

Candidates may record observations not recorded in the mark scheme, but credit should only be given to those observations recorded in the mark scheme.

Question 2 (a)

Test 1 The substance is a mixture and the two components can be easily seen without magnification. Although the sodium iodide is expected to be crystalline it can be described as a solid/powder. Hence the essential observations are white and green solids. Copper carbonate can only be described as green. Light green or pale green or dark green are acceptable, but not any other colour. The deduction must be a compound/ion. Error [-1].

Test 2(a) When added to water the copper carbonate may float or sink. The stirred mixture may appear green. But the essential points will be the filtrate is colourless and the residue/solid left on the filter paper is green. However the word filtrate can be replaced by the solution or the liquid obtained. The use of the word clear is not acceptable. The solid/residue needs to be described as green. It is not a precipitate.

Test 2(b)(i) The precipitate or solid must be yellow. Off white or cream are not acceptable. The symbol I⁻ is acceptable.

Test 2(b)(ii) It is expected that the yellow solid will not dissolve. It may be that bromide or iodide was stated in part (i). This part confirms that iodide is present. However, there is no need to use the word confirm, which is why it is in brackets. If it was said that the iodide *might* be present then the answer is wrong.

Test 2(c) Yellow or orange or both are acceptable. The word ion has been asked for because sodium atoms are not present. Stating sodium is not acceptable because this signifies the free metal.

Test 3(a) The observation needed is practical. Hence a gas given off, which is theoretical, with no observation is not accepted. Bubbling etc is OK.

Test 3(b) The list of acceptable colours lists the test for carbon dioxide as limewater turning milky or cloudy, hence these are the only changes acceptable. White or chalky etc is wrong. The test cannot be for a hydrogencarbonate because the solid is insoluble and hydrogencarbonates are soluble. However, the name hydrogencarbonate could be carried through to the name at the end of the practical exercise.

Test 3 (c) The answer for the test for copper ions is exactly that mentioned in the list of acceptable colours.

The soluble salt is sodium iodide but the formula is acceptable. If both name and formula are given and the formula is wrong the name, if correct, is accepted because the question has asked for name.

If hydrogencarbonate has been mentioned before it is accepted as copper hydrogencarbonate. There is no need for copper(II) but copper(I) is wrong.

If copper iodide and sodium carbonate are quoted the marks are not awarded.

Question 2 (b)

Test 1 One layer formed or the two liquids merge into/form one liquid. Soluble in each other. observation but it can be a deduction.

Test 2 Orange to green are the only acceptable colours according to the list of colours.

Test 3 The reason for the flame could include: the low percentage of carbon; the presence of oxygen in the molecule which helps it to burn;

The substance must contain -OH rather than -CHO because of the lack of smell of aldehydes.

Section B

- 3 (a) (i) $\text{MgO} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2\text{O}$ [2]
 unbalanced [-1]
- (ii) solid remains [1]
- (iii) filter (**not** decant) [1]
- (b) (i) $2\text{Mg}(\text{NO}_3)_2 \rightarrow 2\text{MgO} + 4\text{NO}_2 + \text{O}_2$ [1]
 accept N_2O_4
- (ii) cool (it in ice/cold water) [1]
- (iii) relights [1] glowing splint [1] [2]
 (an extinguished splint is not a glowing splint)
- (iv) white [1]
- (v) no more gas given off/no more bubbles in gas jar/no more colour is
 seen from the solid/weigh test-tube/u-tube to constant mass [1]
- (c) (i) water **chemically** bonded within a crystal structure [1]
- (ii) $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ [1]
- (iii) heat (gently)/stop if a coloured gas is produced [1]
 until constant mass [1] [2]
- (d) $150/24000 = 0.0104 = 0.00625$ [1]
- $\text{Mg}(\text{NO}_3)_2 = 24 + 28 + 96 = 148$ $6\text{H}_2\text{O} = 6 \times 18 = 108$
 $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} = 148 + 108$
 $= 256$
 $3.5\text{g} = 3.5/256 = 0.014$ mol [2]
 $0.014/2 = 0.007$ mol [1]
 $0.00625/0.007 \times 100 = 89.3\%/91.4\%$ etc. [2] [6] 20
- Note $3.5/256 = 0.013672$
 which gives 91.4%
- If magnesium nitrate is used rather than magnesium nitrate crystals
 the % yield is 52.9% [-1]

| | | | | |
|--------------|------------------|--|-------------------|-----------|
| 4 | (a) (i) | $C_2H_5OH + HBr \rightarrow C_2H_5Br + H_2O$ or $C_2H_6O + HBr \rightarrow C_2H_5Br + H_2O$ | [1] | |
| | (ii) | KBr = 39 + 80 = 119 100/119 = 0.84 mol $C_2H_5OH = 24 + 6 + 16 = 46$ 60/46 = 1.3 mol | [1] [1] | [2] |
| | (iii) | 0.84 mol KBr \rightarrow 0.84 mol C_2H_5Br $C_2H_5Br = 24 + 5 + 80 = 109$ $\therefore 0.84 \times 0.8 \times 109 = 73.25\text{g}$ units needed | | [2] |
| 4 | (b) | Use separating funnel [1] add water to bromoethane [1] shake [1] remove stopper and separate layers [1] | | [4] |
| | (c) | To remove water/dry not dehydration | [1] | 10 |
| | 5 | (a) Increase in mass of the halogen atom | [1] | |
| 5 | (b) | more electrons/greater RMM in iodoethane stronger van der Waals | [1] [1] | [2] |
| | (c) | C_2H_5Cl is a gas and must be removed/cool to liquify Fractional distillation collect at bpts | [1] [1] [1] | [3] |
| | Section B | | | 36 |
| Total | | | 90 | |