Rewarding Learning

ADVANCED
General Certificate of Education
2013

Chemistry

Assessment Unit A2 3

Internal Assessment
Practical Examination 2

[AC232]

THURSDAY 16 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 (✓) 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. 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.

- Any number of decimal places may be used provided the 'rounding' is correct.

- 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).

1 Titration exercise

(a) **Rinse** out a pipette with the hard water and **transfer** 25.0 cm^3 of the hard water into a (conical) flask [1]
Add a portion of pH10 buffer solution [1]
Add 4 drops of Eriochrome Black T to the conical flask and swirl [1]
Rinse out the burette with the edta solution and **fill** the burette [1]
Titrate with/add the edta solution from the burette until colour matches reference sample [1]
Rough and two/three accurate titrations [1]

To a maximum of [6] [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. The recorded readings should be checked for mathematical accuracy. [1].

The rough titration value should be greater than the accurate values (no more than 2 cm^3) [1].

Units, i.e. cm^3, should be stated [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 [1]
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	[1]
>0.1	[0]

[8]

(c) red [1] to blue [1] [2]

(d) to remove H^+ [1] and prevent reverse of equilibrium [1] [2]

(e) *assuming an average titre of 22.8 cm^3*
moles edta = $(22.8 \times 0.02)/1000 = 4.56 \times 10^{-4}$
moles $Mg^{2+} = 4.56 \times 10^{-4}$
concentration of $Mg^{2+} = (4.56 \times 10^{-4} \times 1000)/25 = 0.0182$ mol dm^{-3}
mass $Mg^{2+} = 0.018 \times 24 = 0.437$ g
concentration of $Mg^{2+} = 437$ mg dm^{-3}
[–1] each error [5]

Consequential marking/carry error through (cet) to be applied in calculations.

(f) carbonate – white precipitate [1]
hydrogencarbonate – no precipitate/solution remains colourless [1] [2] 25

2 Observation/deduction

There are 28 scoring points available in Question 2.
However the maximum mark for this question is 25.
Please see additional notes at the end of Question 2.

If the candidate scores more than 25 then MAX 25 should be written at beginning of question in the teacher mark column.

(a)

Test	Observations	Deductions
1 Describe the appearance of R.	*pink* [1] *solid*	*Transition metal compound or ion* [1]
2 Add a spatula measure of R to approximately 50 cm^3 of deionised water and stir until there is no further change.	*colourless/pale pink solution* [1]	Mn^{2+}/Co^{2+} [1]
3 Add 5 drops of silver nitrate solution to a test tube containing 2 cm^3 of the solution of R. Allow the mixture to stand.	*white* [1] *ppt* [1] *in pale pink/ colourless solution* [1]	*chloride ion present* [1]
4 Put 2 cm^3 of the solution of R into a test tube. **(a)** Add 5 drops of sodium hydroxide solution and allow to stand. **(b)** Add a further 5 cm^3 of sodium hydroxide solution.	*white* [1] *ppt* [1] *turns brown/black/ darkens* [1] *ppt remains* [1]	*insoluble hydroxide* [1] $Mn^{2+}/Mn(OH)_2/$ $Mn(OH)_2(H_2O)_4$ [1]
5 Place a spatula measure of solid R in a dry boiling tube and heat gently.	*colourless liquid on sides of tube* [1] *crystals change colour* [1]	*hydrated/water of crystallisation present* [1]

Give the name of compound R

hydrated [1] *manganese(II) chloride* [1] [2]

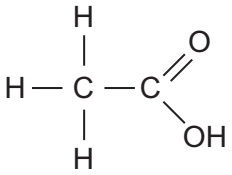
(b)

Test	Observations	Deductions
1 Place 2 cm^3 of S into a boiling tube. Place in a test tube rack. **(a)** Under supervision, cautiously add a very small measure of phosphorus(V) chloride, in a fume cupboard. **(b)** In a fume cupboard, hold the stopper of a bottle of concentrated ammonia solution over the boiling tube used in test **1(a)**.	*steamy fumes* [1] *effervescence* [1] *white smoke* [1]	*–OH group present* [1] *HCl* [1]
2 Place 2 cm^3 of S into a test tube. Add 1 cm^3 of sodium carbonate solution.	*fizz/effervescence* [1]	*S is acidic* [1]

(i) What homologous series does S belong to?

carboxylic acids [1]

(ii) Structure of S



[1]

Max 25

General:

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

Wrong placing of answers

In the observation/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 Crystals is acceptable but not powder. "Transition metal ion/compound" is OK. "Transition metal" is wrong. At this point the word 'possibly' or similar should be used if stating possible ions. Both Mn^{2+} and Co^{2+} are pink but since Mn^{2+} is a much paler shade of pink it would be acceptable at this point to suggest that Mn^{2+} is possibly present without mention of Co^{2+}. Ions must either be given their correct symbol and charge or be referred to as an ion (e.g. "Mn^{2+}" or "manganese ions" are acceptable; "Mn" or "manganese" are not acceptable).

Test 2 The solution is an extremely pale pink colour so "colourless" is also acceptable. Candidates can score here for the same deduction made in **Test 1.** No mark is awarded for deducing that R is soluble as it is referred to as a "solution" in later tests.

Test 3 When allowed to stand a white precipitate will settle at the bottom of the test tube. No other colour is acceptable. "Chloride" or "chloride ion" or "Cl^-" are acceptable. "Chlorine" or "Cl" are not acceptable.

Test 4(a) The list of acceptable colours states that the precipitate formed, $Mn(OH)_2$, is white. However, since it darkens so quickly, the precipitate could legitimately be observed as being cream or beige and these are also acceptable. The list of acceptable colours states that the precipitate turns brown/black on standing but it is acceptable to observe that the precipitate "darkens".

Test 5 The most important observation is the formation of the colourless liquid on the walls of the boiling tube indicating the presence of water of crystallisation, but since the crystals do change colour then this is also accepted. The actual colour is not important. If the only observation is the colour change of the crystals the candidate cannot score a mark for deduction.

Name of R The oxidation state (II) is not necessary but if an incorrect oxidation state is given then a mark is lost.

Question 2 (b)

Test 1(b) The observation could also be described as white fumes.

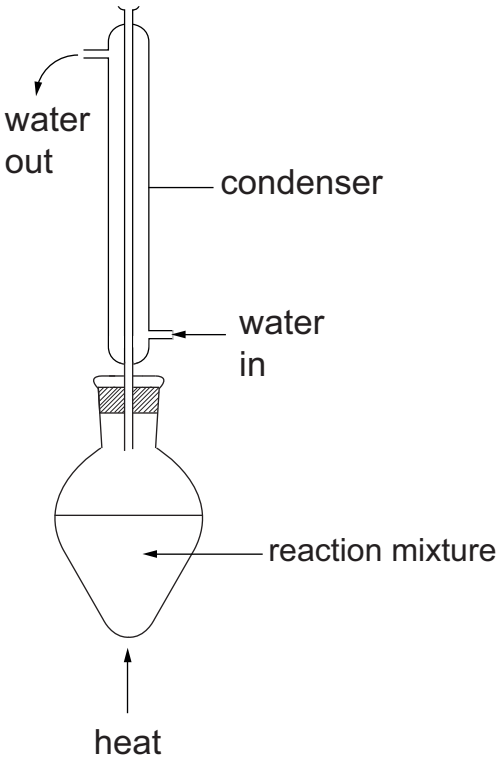
3 Planning Exercise

(a) (i) catalyst [1]

(ii) slowly/dropwise [1] gloves [1] [2]

(b) (i) repeated boiling and condensing of a reaction mixture [1]

(ii)



no heat source [–1]
no double jacket on condenser [–1]
condenser sealed at top [–1]
top of flask open [–1]
no labels [–1] [3]

(c) $(CH_3CO)_2O + H_2O \rightarrow 2\ CH_3COOH$ [2]

(d) to form crystals/solid/product [1]

(e) faster/gives drier product [1]

(f) dissolve in minimum volume of hot water [1]
filter [1]
cool [1] [3]

Quality of written communication [2]

(g) number of moles aspirin = 5 ÷ 180 = 0.028
0.0278 ÷ 65 × 100 = 0.043
number of moles 2-hydroxybenzoic acid = 0.043
mass 2-hydroxybenzoic acid = 0.043 × 138 = 5.9 g [4] 20

Total **70**