Chem Measure; Con Mass + Quant Interp Eq

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.3 Quantitative Chemistry
Sub-Topic	Chem Measure; Con Mass + Quant Interp Eq
Difficulty Level	Gold Level
Booklet	Mark Scheme 1

Time Allowed: **57 minutes**

Score: **/55**

Percentage: **/100**

Grade Boundaries:

M1.(a) (medicine is) a mixture **and**

(designed as) a useful product

1

(b) sugar / flavouring

1

to make it taste better

or

colouring

to make it look more attractive

1

(c) $C_8H_9NO_2$

any order of elements

1

151

1

(d) mass of acetylsalicylic acid = 0.3 g

1

$= \frac{0.3}{100}$ (mol)

method mark – divide mass by M_r

1

= 0.00167 (mol)

allow 0.0016666(66)

1

1.67×10^{-3} (mol)

*correct answer with or without working scores **4** marks*

allow ecf from steps1, 2 and 3

1

[9]

M2.(a) **Level 3 (5–6 marks):**

A full, detailed and coherent plan covering all the major steps is provided, which outlines
the apparatus required and sets out the steps needed in a logical manner that could be followed by another person to produce a pure, dry sample of copper nitrate.

Level 2 (3–4 marks):

The substantive content of a plan is present but may be missing some steps. The plan
may not be in a completely logical sequence but leads towards the production of a pure,
dry sample of copper nitrate.

Level 1 (1–2 marks):

Simple statements relating to relevant apparatus or steps are made but they may not be
in a logical order. The plan would not allow another person to produce the sample.

0 marks:

No relevant content

Indicative content

- pour a suitable volume of nitric acid into a suitable container
- add a small amount of copper carbonate to the acid and stir until the effervescence stops
- continue to add small amounts of copper carbonate to the acid and each time stir until any effervescence stops
- eventually when there is no reaction / effervescence when the copper carbonate is added filter the mixture to remove the excess copper carbonate
- pour the filtrate (copper nitrate solution) into an evaporating basin and heat to evaporate a small amount of the water
- leave the copper nitrate solution to crystallise
- remove the crystals from the solution remaining and dry the crystals

6

(b) 1 mole carbon dioxide = 14 + (16 × 2) = 46 g

1

14 g is 0.30 mole

1

1 mole is 6.02×10^{23} molecules

1

so 14 g has 1.81×10^{23} molecules

*allow 1.81×10^{23} with no working shown for **4** marks*

1

*answer not given in standard form max. **3** marks*

[10]

M3.(a) (i) calcium oxide

in either order

1

carbon dioxide

accept correct formulae

1

(ii) $C(s) + CO_2(g) \rightarrow \mathbf{2}CO(g)$

allow multiples

1

(iii) 210 (tonnes)

*award **3** marks for the correct answer with or without working*

allow ecf for arithmetical errors

*if answer incorrect allow up to **2** marks for any of the steps below:*

160 → 112

300 → 112 / 160 × 300

or

moles Fe_2O_3 = 1.875 (× 10^6) or 300 / 160

moles of Fe = 3.75 (× 10^6) or 2 × moles Fe_2O_3

mass Fe = moles Fe × 56

105 (tonnes) scores 2 (missing 1:2 ratio)

420 (tonnes) scores 2 − taken M_r of iron as 112

3

(b) (i) aluminium is more reactive than carbon **or** carbon is less reactive than aluminium

must have a comparison of reactivity of carbon and aluminium

accept comparison of position in reactivity series.

1

(ii) (because) aluminium ions are positive

ignore aluminium is positive

1

and are attracted / move / go to the negative electrode / cathode

1

where they gain electrons / are reduced / $Al^{3+} + 3e^- \rightarrow Al$

accept equation or statements involving the wrong number of electrons.

1

(iii) (because) the anodes **or** (positive) electrodes are made of carbon / graphite

1

oxygen is produced (at anode)

1

which reacts with the electrodes / anodes

*do **not** accept any reference to the anodes reacting with oxygen from the air*

*equation $C + O_2 \rightarrow CO_2$ gains **1** mark (M3)*

1

[13]

M4.(a) left hand: (conical) flask

*do **not** accept round bottomed flask or container which is not a flask*

1

right hand: beaker / trough

accept plastic box

1

(b) (i) 157

1

(ii) all calcium carbonate used up **or** reaction stopped
*do **not** accept all acid used up*
1

(c) (i) 0.007(272727…)
*correct answer with or without working gains **2** marks*
*if answer incorrect, allow (0.32 / 44) for **1** mark*
2

(ii) 0.007(272727…)
*allow ecf from **(c)(i)***
1

(iii) (M_r = mass / moles = 1 / 0.00727…) = 137.5 or 138
*allow ecf from **(c)(ii)***
if use 0.00943 moles then = 106
if use 0.007 allow 143 (142.857)
1

(iv) (138) – 60 (= 78)
23 / 85
1

(78 / 2) = 39
1

potassium
sodium / rubidium
*identity of metal ecf on A_r, but **must** be Group 1*
*If no working max **1** mark*
1

(d) (i) (relative atomic mass) would decrease
1

because the mass lost greater

1

so moles carbon dioxide larger **or** moles metal carbonate greater

1

(ii) no change

1

because the acid (already) in excess

1

so the amount carbon dioxide lost is the same

1

[17]

M5.(a) copper has delocalised electrons

*accept copper has free electronsignore sea of electrons **or** mobile electrons*

1

(electrons) which can move through the metal / structure

allow (electrons) which can carry a charge through the metal / structure

1

(b) (i) (M_r $FeCl_3$ =) 162.5

*correct answer with or without working gains **3** marks*

*can be credited from correct substitution in step **2***

1

or

2 (moles of) $FeCl_3$ = 325

or

112 → 325

$$\frac{11.20}{56} \times 162.5$$

allow ecf from step 1

accept $\frac{325}{112} \times 11.2$

1

= 32.5

accept 32.48

1

(ii) 74.8

accept 74.77 - 75

accept ecf from (b)(i)

if there is no answer to part(i)

or

if candidate chooses not to use their answer then accept 86.79 - 87

1

[6]