

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	Silver Level
Booklet	Mark Scheme 1

Time Allowed: 57 minutes

Score: /58

Percentage: /100

Grade Boundaries:

M1.(a)	408 kg	1
(b)	all points correct $\pm \frac{1}{2}$ small square <i>allow 1 mark if 5 points correct</i> best fit line	2 1
(c)	$\frac{1989}{36} \times 100$	1
	5525 dm ³	1
(d)	relative formula mass of TiCl ₄ is 190	1
	25.26 %	1
	Answer given to 3 significant figures = 25.3 %	1
	<i>25.23% with or without working gains 3 marks</i>	
(e)	argon is unreactive	1

water (vapour) would react with sodium

allow water (vapour) would react with titanium(IV) chloride

1

and air contains oxygen that would react with reactants

allow and air contains oxygen that would react with products

1

- (f) (titanium conducts electricity) because electrons in the outer shell of the metal atoms are delocalised

1

and so electrons are free to move

allow the delocalised electrons in the metal carry electrical charge through the metal

1

through the whole structure

1

[15]

M2.(a) magnesium loses electrons

there are four ideas here that need to be linked in two pairs.

1

two electrons

1

chlorine gains electrons

magnesium loses electrons and chlorine gains electrons scores 2 marks.

1

two atoms of chlorine

magnesium loses two electrons and two chlorines each gain one electron will score full marks.

1

(b) 95

correct answer with or without working gains **2** marks
if answer incorrect, allow $24 + 35.5 + 35.5$ for **1** mark

2

[6]

M3.Divide by A.:

$$\text{Na} = 22.8 / 23$$

$$\text{B} = 21.8 / 11$$

$$\text{O} = 55.4 / 16$$

if student has calculated moles upside down they can score
mp 3 mp 4 and mp 5 as follows:

$$\text{Na } 23 / 22.8$$

$$\text{B } 11 / 21.8$$

$$\text{O } 16 / 55.4$$

1

Values

0.991

1.01

1.98

0.505

3.46

0.289

1

Divide by the smallest

1 : 2 : 3.5

Divide by the smallest (1)

3.5 : 1.75 : 1

1

Whole number ratio

2 : 4 : 7

Whole number ratio (1)

14 : 7 : 4

1

Empirical formula

$\text{Na}_2\text{B}_4\text{O}_7$

Empirical formula (1)

$\text{Na}_{14}\text{B}_7\text{O}_{47}$

if no working shown allow 4 marks for $\text{Na}_2\text{B}_4\text{O}_7$

1

[5]

M4.(a) because they are gases

ignore vapours / evaporate / (g)

allow it is a gas

1

(b) (i) 80 / 79.5

correct answer with or without working = 2 marks

ignore units

*if no answer **or** incorrect answer then evidence of*

64 / 63.5 + 16 gains 1 mark

2

(ii) 79.375 - 80

correct answer with or without working = 2 marks

*if no answer **or** incorrect answer then evidence of*

$$\frac{64}{80} \text{ or } \frac{63.5}{79.5} (\times 100) \text{ gains 1 mark}$$

accept (ecf) $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}} \times 100$ for 2 marks
if answer correctly calculated.

if incorrectly calculated evidence of $\frac{64 \text{ or } 63.5}{\text{answer (b)(i)}} (\times 100)$ gains 1 mark

2

(iii) 3.2

correct answer with or without working = 1 mark
allow (ecf)
 $4 \times ((b)(ii)/100)$ for 1 mark if correctly calculated

1

(c) (i) 3.3

accept 3.33..... or $3 \frac{1}{3}$ or 3.3•
or 3.3r

1

(ii) (measure to) more decimal places or (use a) more sensitive balance / apparatus

allow use smaller scale (division) or use a smaller unit
ignore accurate / repeat

1

(iii) any **two** from:

ignore systematic / human / apparatus / zero / measurement
/ random / weighing / reading / recording errors unless
qualified

different balances used or faulty balance

ignore dirty apparatus

reading / using the balance incorrectly

accept incorrect weighing of copper / copper oxide

spilling copper oxide / copper

allow some copper left in tube

copper oxide impure

allow impure copper (produced)

not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used

accept not all copper oxide (fully) reacted

heated for different times heated at different temperatures

if neither of these points awarded allow different amounts of heat used

accept Bunsen burner / flame at different temperatures

some of the copper produced is oxidised / forms copper oxide

some of the copper oxide / copper blown out / escapes (from tube)

ignore some copper oxide / copper lost

some water still in the test tube

2

[10]

M5.(a) (i) the more sodium hydrogencarbonate the greater the temperature change

accept examples from the table

1

up to 8 spatula measures

accept any correct indication of when change occurs

1

then the temperature change is constant

if no marks awarded allow 1 mark for:

the more sodium hydrogencarbonate the lower the final temperature

1

(ii) energy is taken in from the surroundings **or** endothermic

1

(b) (i) gas / carbon dioxide / steam / water is produced

accept carbon dioxide is a gas **or** steam / water is a gas
allow gas / air expands when heated

1

- (ii) no, because (reaction) is exothermic **or** yes, to start the reaction
allow no, because (reactants) were formed by heating
ignore references to cooling

1

- (c) (i) 84

correct answer with or without working gains **2** marks
if no answer or incorrect answer then evidence of $23 + 1 + 12$
 $+ (3 \times 16)$ gains **1** mark

2

- (ii) 14.29

accept rounding to 14.3 or 14
allow ecf from (c)(i)

1

[9]

- M6.(a)** (i) M_r of $\text{NH}_3 = 17$

correct answer with or without working gains **3** marks
accept correct rounding of intermediate answers
can be credited from correct substitution from step 2

1

or

2 (moles of) $\text{NH}_3 = 34$

or

14 \rightarrow 17

or

28 \rightarrow 34

$$(28/34) \times 6.8$$

allow ecf from step 1

1

or

$$(14/17) \times 6.8$$

$$= 5.6$$

allow ecf from step 1

1

(ii) 61.8

*accept 61.76 **or** 62 **or** 61.76...*

correct answer with or without working gains 2 marks

if answer is not correct evidence of $4.2 / 6.8 \times 100$ gains 1 mark

if answer not correct 0.618 or 0.62 gains 1 mark

2

(iii) reaction is reversible

accept reaction reaches equilibrium

allow reaction does not reach completion

ignore some is lost

1

(b) 3 bonding pairs

*do **not** accept extra electrons on hydrogen*

1

1 lone pair

accept 2 non-bonding electrons on outer shell of nitrogen

1

(c) (i) hydroxide / OH⁻

accept phonetic spelling

1

(ii) neutralisation

accept acid-base

allow exothermic

1

(iii) nitric (acid)

allow HNO₃

ignore incorrect formula

1

(iv) (NH₄)₂ SO₄

allow (NH₄⁺)₂ SO₄²⁻

1

[12]