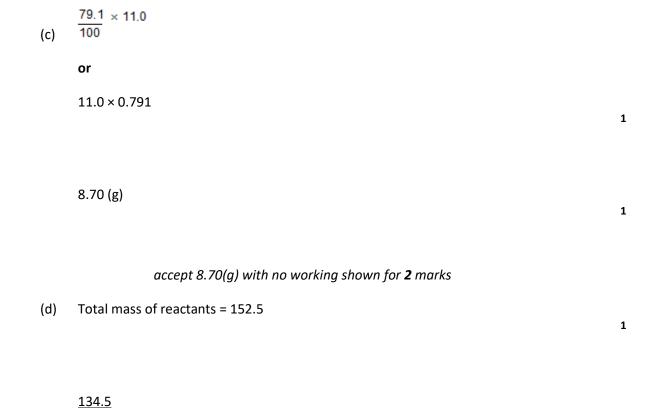
M1 .(a)	add exc	ress copper carbonate (to dilute hydrochloric acid) accept alternatives to excess, such as 'until no more reacts'	1
		filter (to remove excess copper carbonate) reject heat until dry	1
		heat filtrate to evaporate some water or heat to point of crystallisation accept leave to evaporate or leave in evaporating basin	1
		leave to cool (so crystals form) until crystals form	1
	(b)	must be in correct order to gain 4 marks $M_{r} \operatorname{CuCl}_{2} = 134.5$ $correct \ answer \ scores \ \textbf{4} \ marks$	1
		moles copper chloride = (mass / M_r = 11 / 134.5) = 0.0817843866	1
		<i>M</i> _r CuCO ₃ = 123.5	1
		Mass CuCO ₃ (=moles × M_2 = 0.08178 × 123.5) = 10.1(00)	1



accept 10.1 with no working shown for 4 marks

152.5

allow ecf from step 1

1

88.20 (%)

allow 88.20 with no working shown for 3 marks

(e) atom economy using carbonate lower because an additional product is made or carbon dioxide is made as wellallow ecf

[14]

12. (a)	(delive	ry) tube sticks into the acid	1
		the acid would go into the water or the acid would leave the flask or go up the delivery tube ignore no gas collected	1
	(b)	any one from: • bung not put in firmly / properly	
		 gas lost before bung put in leak from tube 	1
	(c)	all of the acid has reacted	1
	(d)	take more readings in range 0.34 g to 0.54 g	1
		take more readings is insufficient ignore repeat	
	(e)	<u>95</u> 24000	1
		0.00396	
		or 3.96×10^{-3}	a
			1

(f)	use a pipette / burette to measure the acid	1
	because it is more accurate volume than a measuring cylinder or greater precision than a measuring cylinder or use a gas syringe to collect the gas so it will not dissolve in water	
	use a flask with a divider accept description of tube suspended inside flask so no gas escapes when bung removed	1
(g)	they should be collected because carbon dioxide is left in flask at end	1
	and it has the same volume as the air collected / displaced	1 [11]

M3.(a) X: Fe²⁺ / iron(II), SO₄²⁻ / sulfate allow iron(II) sulfate or FeSO4 1 Y: Na⁺ / sodium, I⁻ / iodide allow sodium iodide **or** Nal 1 Z: Fe³⁺ / iron(III), Br⁻ / bromide allow iron(III) bromide or FeBr₃ correct identification of any two ions = one mark correct identification of any four ions = two marks 1 any five from: (b) allow converse arguments

method 1

- weighing is accurate
- not all barium sulfate may be precipitated
- precipitate may be lost
- precipitate may not be dry
- takes longer
- requires energy

allow not all the barium hydroxide has reacted

method 2

- accurate
- works for low concentrations allow reliable / precise

[8]

5

M4.(a) copper has delocalised electrons

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

1

(electrons) which can move <u>through the metal / structure</u>

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

1

(b) (i)
$$(M, FeCl_3 =) 162.5$$

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

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

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

[6]

1