

RELATIVE FORMULA MASS, ATOM ECONOMY & PERCENTAGE YIELD 1

MARK SCHEME

Q1.

Question	Answer	Extra information	Marks
(i)	21	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	1
(ii)	84	correct answer with or without working = 2 marks allow ecf from 3(b)(ii) correctly calculated for 2 marks allow evidence of $21/25$ or $(i)/25$ for 1 mark	2
Total marks			3

Q2.

Question	Answer	Extra information	Marks
(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	1
Total marks			3

Q3.

Question	Answer	Extra information	Marks
(i)	M_r of $\text{NH}_3 = 17$ or 2 (moles of) $\text{NH}_3 = 34$ or $14 \rightarrow 17$ or $28 \rightarrow 34$ $(28/34) \times 6.8$ or $(14/17) \times 6.8$ $= 5.6$	correct answer with or without working gains 3 marks accept correct rounding of intermediate answers can be credited from correct substitution from step 2 allow ecf from step 1 allow ecf from step 1	 1 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
Total marks			6

Q4.

Question	Answer	Extra information	Marks
(i)		correct answer with or without working gains 3 marks can be credited from correct substitution in step 2	 1

	$(M_r \text{ FeCl}_3 =) 162.5$ or $2 \text{ (moles of) FeCl}_3 = 325$ or $112 \rightarrow 325$ $\frac{11.20}{56} \times 162.5$ $= 32.5$	allow ecf from step 1 accept $\frac{325}{112} \times 11.2$ accept 32.48	1 1
(ii)	74.8	accept 74.77 - 75 accept ecf from (i) if there is no answer to part(i) or if candidate chooses not to use their answer then accept 86.79 - 87	1
Total marks			4

Q5.

Question	Answer	Extra information	Marks
	$\frac{3.81}{63.5}$ $= 0.06$ 3 Cu_3N	$\frac{0.28}{14}$ $= 0.02$ 1 ecf allowed from step 2 to step 3 and step 3 to step 4 if sensible attempt at step 1 correct formula gains 1 mark	1 1 1 1
Total marks			4

Q6.

Question	Answer	Extra information	Marks
	52.9(411765) / 53	correct answer with or without working = 2 marks if answer incorrect allow $2 \times 27 = 54$ or $27/102 \times 100$ or 26.5 for 1 mark	2
Total marks			2

Q7.

Question	Answer	Extra information	Marks
	$M_r \text{ CaO} = 56$ and $M_r \text{ Ca(OH)}_2 = 74$		1
	$2/56 (x74)$ or $0.036 (x74)$ or $74/56 (x2)$ or $1.3(214\dots) (x2)$	allow ecf from step 1	1
	2.6(428...) in range 2.6 to 2.96	correct answer with or without working gains 3 marks allow ecf carried through from step 1 ignore final rounding to 3	1
Total marks			3

Q8.

Question	Answer	Extra information	Marks
(a)	N_2O		1
(b)	13.8 to 14	gains full marks without working if answer incorrect 13 gains 1 mark or $14/101 \times 100$ gains 1 mark	2

Total marks			3
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Q9.

Question	Answer	Extra information	Marks
	152	correct answer with or without working = 2 marks 56 + 32 + (4 × 16) gains 1 mark ignore any units	2
Total marks			2

Q10.

Question	Answer	Extra information	Marks
(a)	2.61 / range 2.5 to 2.7	correct answer with or without or with wrong working gains 2 marks (accept answers between 2.5 and 2.7) if answer incorrect moles of salicylic acid = $2/138 = 0.0145$ moles ie $2/138$ or 0.0145 gains 1 mark or $(180/138) \times 2$ gains 1 mark or $1 \text{ g} \rightarrow 180/138 = (1.304 \text{ g})$ gains 1 mark (not 1.304g alone)	2
(b)	42.1 range 40.7 to 42.3	accept correct answer with or without or with wrong working for 2 marks	2
(c)	any one from: <ul style="list-style-type: none"> • errors in weighing • some (of the aspirin) lost • not all of the reactant may have been converted to product • the reaction is reversible • side reactions • reactants impure • not heated for long enough 	do not allow 'lost as a gas' e.g. reaction didn't go to completion allow loss of some reactants accept other products / chemicals ignore waste products	1

	• not hot enough for reaction to take place		
Total marks			5

Q11.

Question	Answer	Extra information	Marks
(i)	3400	<p>correct answer gains all 3 marks with or without working</p> <p>if answer incorrect: 1700 with or without working or $6000 \times (34/60)$ gains 2 marks or 6800 gains 2 marks with or without working</p> <p>or</p> <p>moles of urea = $6000/60 = 100$ gains 1 mark</p> <p>moles of ammonia needed = 200 gains 1 mark</p> <p>or</p> <p>$6000 \times (17/60)$ gains 1 mark or $(2 \times 17) \rightarrow 60$ gains 1 mark or $34 \rightarrow 60$ gains 1 mark</p>	3
(ii)	76.9	<p>correct answer gains 2 marks with or without working. allow 77 or 76.923...</p> <p>allow 76 or 0.77 or 0.76923 for 1 mark</p> <p>if answer incorrect allow 1 mark for either identifying the mass of the useful product or the total M_r of reactants – this can be awarded from the numbers in the calculation:</p> <p>M_r of useful product = 60</p>	2

		M_r of reactants = 78 or $(2 \times 17) + 44$ or $60 + 18$ $60/78 \times 100$ gains 1 mark	
Total marks			5

Q12.

Question	Answer	Extra information	Marks
	65	correct answer with or without working = 2 marks if answer incorrect evidence of $(81 - 16)$ for 1 mark ignore units	2
Total marks			2

Q13.

Question	Answer	Extra information	Marks
(i)	16	correct answer with or without working accept correct rounding if the answer is incorrect then check the working. for 1 mark look for correct method in one line of the working. Moles of CO = $14/28$ or 0.5 or Mass of CH ₃ OH = 0.5×32 or $28 \rightarrow 32$ or $14 \rightarrow 32/2$	2
(ii)	75	correct answer with or without working if the answer is incorrect $12/16 \times 100$ gains 1 mark OR if working from 18g 66.6 recurring or correctly rounded to a max of 67 = 2 marks	2

		incorrect rounding eg 66 = 1 mark	
(iii)	reversible reaction or not all reactants converted to product (owtte) or other sensible reason such as: loss of product / reactant or impurities in reactants or side reactions / other products or temperature too high / pressure too low	allow 'it did not all react' allow gas is lost ignore mass lost ignore some is lost	1
Total marks			5