

RELATIVE FORMULA MASS, ATOM ECONOMY & PERCENTAGE YIELD 2

MARK SCHEME

Question 1

Question	Answer	Extra information	Marks
(a)	157	correct answer with or without working (2 × 19 + 119) for 1 mark only allow (119 + 19 =) 138 for 1 mark only ignore units	2
(b)	24.2	accept answers in the range 24 to 24.2038..... ignore incorrect rounding after correct answer 25 only without working gains 1 mark or 38/157 × 100 gains 1 mark or (19/157 × 100 =) 12 to 12.1 gains 1 mark allow error carried forward from part(a) 38/(a) × 100 gains 2 marks if calculated correctly (19/138 × 100 =) 13.8 gains 1 mark	2
(c)	0.29	accept answers in the range 0.28 to 0.3 allow error carried forward from part (b) (b)/100 × 1.2 correctly calculated ignore units	1
Total marks			5

Question 2

Question	Answer	Extra information	Marks
(a)	25.4(%)	correct answer with or without working accept 25(%) accept 25.433....(%) allow 26(%) for 1 mark if incorrect answer 1 mark for identification of 44 as M_r of useful product or 173 as total M_r of reactants / products	2
(b)	any two sensible ideas from eg: <ul style="list-style-type: none">• no / less waste• less materials / reactants needed / used• fewer / no environmental problems or less / no pollution• better for sustainable development / resources running out• more useful use of atoms• less purification / separation of products owtte	ignore references to energy / cheaper / profit / cost / efficient	2
(c)	reduce yield or less product owtte	allow no yield ignore waste / less efficient	1
Total marks			5

Question 3

Question	Answer	Extra information	Marks
(i)	143	correct answer with or without working = 2 marks ignore units if answer is not correct $40 + (2 \times 35.5) + (2 \times 16)$ gains 1 mark	2
(ii)	49.7% (49.6 to 50)	correct answer with or without	2

	<p>any two sensible ideas from eg:</p> <ul style="list-style-type: none"> • no / less waste • less materials / reactants needed / used • fewer / no environmental problems or less / no pollution • better for sustainable development / resources running out • more useful use of atoms • less purification / separation of products owtte 	<p>working = 2 marks answer 49 gains 1 mark if answer is not correct: $(71 \div 143) \times 100$ gains 1 mark allow error carried forward from part (i) i.e. $(71$ or their $(2 \times 35.5) \times$ answer to (i) $\times 100$ gains 2 marks if calculated correctly and 1 mark if not calculated correctly. Special case $35.5 \div 143 \times 100 =$ 24.8 to 25% or $35.5 \div$ answer to (i) $\times 100$ correctly calculated for 1 mark</p>	
(iii)	9.9 to 10g	allow ecf from (i) or (ii)	1
Total marks			5

Question 4

Question	Answer	Extra information	Marks
	84 / 84.5 / 83.98	<p>correct answer with or without working gains 3 marks (moles of $\text{NaN}_3 =$) $130/65$ (1) moles of nitrogen = 3 (1) mass of nitrogen = $3 \times 28 = 84$ (1) or $2 \times (23 + (3 \times 14))$ (1) $3 \times (2 \times 14)$ (1) or $2\text{NaN}_3 = 130$ (1) $3\text{N}_2 = 84$ (1) if answer is incorrect then look for evidence of correct working. allow ecf from previous stage 1 mark lost for each mistake in the working if they do not have the correct answer.</p>	3
Total marks			3

Question 5

Question	Answer	Extra information	Marks
(i)	162.5	correct answer with or without working gains 2 marks if no answer or incorrect answer then evidence of correct working $[56 + (3 \times 35.5)]$ gains 1 mark	2
(ii)	34.46	accept rounding from 34 - 34.5 correct answer with or without working gains 2 marks accept ecf from (i) correctly calculated for 2 marks if no answer or incorrect answer then evidence of $56 / 162.5$ or $56 / \text{answer to (i)}$ gains 1 mark	2
Total marks			4

Question 6

Question	Answer	Extra information	Marks
(i)	58.5		1
(ii)	mole		1
Total marks			2

Question 7

Question	Answer	Extra information	Marks
	any two from: <ul style="list-style-type: none">• more of the starting materials end up as useful products• less / fewer reactants / atoms used or method 1 has more reactants / atoms used• method 1 has 4 reactants• method 2 has 2 reactants• less / fewer (waste) products / atoms in the products or method 1 has more (waste) products / atoms in products	accept 'less chemicals / compounds / substances used' ignore less elements / materials used accept method 1 uses 4 chemicals accept method 2 uses 2 chemicals accept less waste	2

	<ul style="list-style-type: none"> • in method one there are 2 waste products / 15 waste atoms (or similar idea) • in method two there is only one waste product / only 3 wasted atoms <p>or</p> <p>correctly calculated atom economies for both marks</p> <p>method 1 : 21.3% (1)</p> <p>method 2 : 76.9% (1)</p> <p>atom economy equation correctly stated</p> $\text{atom economy} = \frac{M_r \text{ of useful product}}{(\text{total}) M_r \text{ of reactants}} \times 100$ $\text{atom economy} = \frac{M_r \text{ of useful product}}{(\text{total}) M_r \text{ of products}} \times 100$	<p>accept unwanted chemicals for waste products</p> <p>accept converse</p> <p>ignore purification / pollution</p> <p>accept 21%</p> <p>accept 77%</p>	
Total marks			2

Question 8

Question	Answer	Extra information	Marks
(a)	80	<p>correct answer with or without working gains 2 marks</p> <p>ignore units</p> <p>if answer incorrect, evidence of correct working gains 1 mark</p> <p>e.g.</p> $14 + (4 \times 1) + 14 + (3 \times 16) (= 70)$ <p>or</p> $2N + 4H + 3O$	2
(b)	<p>fertiliser is C</p> <p>evidence of correct working</p>	<p>examples of minimum correct working:</p> <p>39/101</p> <p>or</p> <p>14/101</p> <p>or</p> <p>38.61/100</p> <p>or</p> <p>13.86/100</p>	1 1
Total marks			4

Question 9

Question	Answer	Extra information	Marks
(i)	165	if answer is not correct then evidence of correct working gains one mark e.g. $(10 \times 12) + 15 + 14 + 16$	2
(ii)	10.37 (%)	accept 10 / 10.4 / 10.37..... if answer is not correct then evidence of correct working gains one mark eg minimum evidence would be 14 / 135	2
Total marks			4

Question 10

Question	Answer	Extra information	Marks
(i)	$(M_r \text{ MgO} =) 40$	accept $(2 M_r \text{ MgO} =) 80$	1
	1.2/24 (x40) or 0.05 (x40) or 40/24 (x1.2) or 1.67 (x1.2) 2(.0)	allow ecf from step 1	1
		allow ecf carried through from step 1 correct answer with or without working gains 3 marks	1
(ii)	75(%)		1
(iii)	any one from: <ul style="list-style-type: none"> the reaction is reversible some lost /escaped/ released (when separated) some of the reactant may react in different ways from the expected reaction impure reactant(s) 	accept incomplete reaction ignore equilibrium not reached ignore measurement and	1

		calculation errors	
Total marks			5