

Question	Answer	Marks	AO Element	Notes	Guidance
1	89.6 (g)	1			
2(a)	moles $\text{N}_2 = (144 / 24 =) 6$	1			
2(b)	moles $\text{NaN}_3 = (6 \times 2 / 3 =) 4$	1			
2(c)	$M_r \text{ NaN}_3 = 65$	1			
2(d)	$(4 \times 65 =) 260$	1			
3(a)	80	1			
3(b)	5	1			
3(c)	10	1			
3(d)	240	1			
4(a)	0.003	1			
4(b)	0.006	1			
4(c)	30	1			

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5	$\text{mol FeSO}_4 = 15.2 / 152$ $= 0.1(00)$ $\text{expected mol of Fe}_2\text{O}_3 = 0.1 / 2$ $= 0.05(00)$ or $\text{actual mol of Fe}_2\text{O}_3 = 4.80 / 160$ $= 0.03(00)$ percentage yield $= 100 \times 0.03(00) / 0.05(00)$ $= 60\%$	3			
6(a)	yellow	1			
6(b)	$0.2 \times 25 / 1000 =$ $5(.00) \times 10^{-3}$ or 0.005(00) (mol) $5(.00) \times 10^{-3} / 2 =$ $2.5(.0) \times 10^{-3}$ or 0.0025(0) (mol) $2.5(.0) \times 10^{-3} \times 1000 / 20 =$ $0.125 \text{ (mol/dm}^3\text{)}$ $0.125 \times 98 =$ $12.25 \text{ (g/dm}^3\text{)}$	4			
7(a)	(Mol KOH =) $0.00125 /$ 1.25×10^{-3}	1			
7(b)	(Mol H_2SO_4 =) $0.000625 /$ 6.25×10^{-4}	1			ecf from (a)

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7(c)	(Conc H_2SO_4 =) $0.03125 / 3.125 \times 10^{-2}$ (mol/dm ³)	1			ecf from (b)
7(d)	<p>M1 repeat without indicator using same volumes</p> <p>M2 evaporate / heat / warm / oil / leave in sun</p> <p>M3 until most of the water is gone / some water left / saturation(point) / crystallisation point / evaporate some of the water</p> <p>M4 leave / (allow to) cool / allow to crystallise</p> <p>M5 details of drying</p>	5			
8	the formula is P_4O_6 or (one mole of) P_2O_3 = 110 (g) (1) mass = 220 (g)	2			
9(a)	mol of Y = $(0.060 / 24.0 =) 2.5 \times 10^{-3}$ OR 0.0025	1			
9(b)	Mr = $(0.095 / 2.5 \times 10^{-3} =) 38(.0)$ (1) fluorine (1)	2			

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10	mass of O = $3.87\text{ g} - 1.68\text{ g} = 2.19\text{ (g)}$ (1) mol of P = $1.68 / 31$ OR 0.054... AND mol of O = $2.19 / 16$ OR 0.13... (1) ratio of P:O = 1:2.5 (1) whole number ratio AND P_2O_5 (1)	4			
11	$60 / 12 : 13.33 / 1 : 26.67 / 16$ or evaluation $5 : 13.33 : 1.67$ or $3:8:1$ (1) $\text{C}_3\text{H}_8\text{O}$ (1)	2			
12	$(\text{C}_2\text{H}_4\text{O} =) 44$ (1) $\text{C}_4\text{H}_8\text{O}_2$ (1)	2			
13	D - 0.001 mol	1			
14	D - $\text{C}_2\text{H}_4\text{O}_2$	1			
15	C - 0.125 mol/dm^3	1			

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16(a)	M1 Action of heat or catalyst or thermal decomposition (on an alkane)	1		ignore steam ignore pressure	
	M2 Long-chained molecules or alkanes form smaller molecules or forms smaller alkenes (or alkanes)	1		not smaller fractions	
16(b)	$C_{10}H_{22}$	1			
17(a)	C_4H_8 only CH_2	2		Allow C_1H_2	
17(b)	Any unambiguous structural formula of methyl cyclopropane or but-1-ene or but-2-ene or methyl propene	1			
17(c)	M1 same molecular formula	1			

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	M2 different structural formulae or different structures or different arrangement of atoms	1			
17(d)	If 'No': one an alkane, the other an alkene or one is saturated / has single bonds, the other is unsaturated / has a double bond If 'yes' both alkanes or both saturated	1		ignore: references to the functional group ignore: references to the functional group	
18	number of moles of ethanoic acid = 0.1	1			
	number of moles of ethanol = 0.12(0)	1			
	the limiting reagent is ethanoic acid	1			
	number of moles of ethyl ethanoate formed = 0.1	1			

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	maximum yield of ethyl ethanoate is 8.8 g	1			
19(a)(i)	rate at t_2 less than at t_1 or the rate decreases	1			
	rate at t_3 zero / reaction stopped	1			
19(a)(ii)	rate at t_2 less than at t_1 because concentration of hydrogen peroxide is less at t_2 or concentration of hydrogen peroxide is decreasing.	1			
	(rate at t_3 zero / reaction stopped because) hydrogen peroxide is used up	1			
19(b)(i)	steeper and must come from the origin	1			
	final volumes the same	1			

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19(b)(ii)	Any two from: steeper curve because of a faster rate faster rate because of increased surface area same amount / volume / mass / no of mol of hydrogen peroxide ecf for M1 for a shallower curve because of slower rate.	2			
19(c)	filter (and rinse / wash)	1			
	dry manganese(IV) oxide	1			
	weigh / measure mass manganese(IV) oxide after reaction	1			
	the mass should be 0.1 g or unchanged.	1			
19(d)(i)	number of moles of O ₂ formed = 0.096 / 24 = 0.004	1			
19(d)(ii)	number of moles of H ₂ O ₂ in 40 cm ³ of solution = 0.004 × 2 = 0.008	1			
19(d)(iii)	concentration of the hydrogen peroxide in mol / dm ³ = 0.008 / 0.04 = 0.2	1			

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