

Paper 1 (4CH1/1C and 4SD0/1C)

Question number	Answer	Mark
1(a)	Nucleus	1

Question number	Answer	Mark
1(b)	Proton	1

Question number	Answer	Additional guidance	Mark
1(c)	Equal numbers of protons and electrons	accept equal numbers of positive and negative particles/charges	1

Question number	Answer	Mark
1(d)	5	1

Question number	Answer	Mark
1(e)	Lithium	1

Total for Question 1 = 5 marks

Question number	Answer	Additional guidance	Mark
2(a)(i)	An explanation that makes reference to the following two points: - boxes 1 and 2 (1) - because they both have only one type of atom/molecule (1)	accept other indications, e.g. only He and only H-H accept species in place of atom/molecule second mark can be awarded if only box 1 or box 2 identified	2

Question number	Answer	Additional guidance	Mark
2(a)(ii)	An explanation that makes reference to the following two points: - boxes 3 and 5 (1) - because they both have two different molecules (1)	second mark can be awarded if only box 3 or box 5 identified	2

Question number	Answer	Mark
2(b)(i)	Simple distillation	1

Question number	Answer	Mark
2(b)(ii)	Chromatography	1

Question number	Answer	Mark
2(b)(iii)	Crystallisation	1

Total for Question 2 = 7 marks

Question number	Answer	Mark
3(a)	Reversible arrow	1

Question number	Answer	Additional guidance	Mark
3(b)(i)	(X) ammonium chloride (1) (Y) ammonia and hydrogen chloride (1)	accept formulae	2

Question number	Answer	Mark
3(b)(ii)	D (subliming)	1

Question number	Answer	Additional guidance	Mark
3(c)	An explanation that makes reference to the following three points: - C (1) - because ammonia molecules have lower mass or smaller M_r (hence travel faster) (1) - and so travel further in the same time (1)	accept reverse arguments for hydrogen chloride	3

Total for Question 3 = 7 marks

Question number	Answer	Additional guidance	Mark
4(a)	• 35 (1) • 41 (1)	final answer consequential on syringe readings	2

Question number	Answer	Additional guidance	Mark
4(b)	• Calculation of volume of oxygen used • Calculation of original volume of air • Calculation of percentage Example calculation: $80 - 43 = 37 \text{ (cm}^3\text{)} (1)$ $100 + 10 + 80 = 190 \text{ (cm}^3\text{)} (1)$ $(37 \times 100) \div 190 (= 19.47\%)$ $= 19\% (1)$	accept 19.47% or 19.5%	3

question number	answer	mark
4(c)	• Decreased (1) • Decreased (1) • No effect (1)	3

Total for Question 4 = 8 marks

Question number	Answer	Mark
5(a)	Any two of: - concentration of copper(II) sulfate solution (1) - volume of copper(II) sulfate solution (1) - particle size of metal (1)	2

Question number	Answer	Additional guidance	Mark
5(b)(i)	(G) 5.5 (°C) (1) (H) 11.5 (°C) (1)	accept 5.47	2

Question number	Answer	Mark
5(b)(ii)	An explanation that makes reference to the following two points: - H (1) - because of the biggest temperature increase (1)	2

Question number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation that makes reference to the following two points: - F (1) - because there is no temperature increase (1)	accept there is no reaction	2

Total for Question 5 = 8 marks

Question number	Answer	Additional guidance	Mark
6(a)	The atoms of both elements have one electron in the outer shell	accept highest energy level in place of outer shell	1

Question number	Answer	Additional guidance	Mark
6(b)(i)	A description that makes reference to any two of the following points: - sodium floats/moves across the water (1) - sodium melts (1) - sodium disappears/gets smaller (1) - effervescence/fizzing/bubbles/gas given off (1) - white trail (1)	accept highest energy level in place of outer shell accept forms a ball accept sodium dissolves ignore name of gas	2

Question number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation that makes reference to the following points: (final colour is) purple/blue (1) - because the solution is alkaline (1)	accept sodium hydroxide forms/ solution has high pH	2

Question number	Answer	Mark
6(b)(iii)	D (12)	1

Question number	Answer	Mark
6(c)	Lithium	1

Question number	Answer	Additional guidance	Mark
6(d)	Potassium catches fire	accept lilac/purple/violet flame	1

Question number	Answer	Additional guidance	Mark
6(e)	$2\text{Rb} + 2\text{H}_2\text{O} \rightarrow 2\text{RbOH} + \text{H}_2$ (1)	accept multiples and fractions	1

Total for Question 6 = 9 marks

Question number	Answer	Mark
7(a)(i)	B and E	1

Question number	Answer	Mark
7(a)(ii)	(the only one that shows) All atoms and all bonds	1

Question number	Answer	Mark
7(a)(iii)	- D and F (1) - they have the same molecular formula/the same number of each type of atom (1) - but different structures/atoms joined together in different ways/different structural formulae (1)	3

Question number	Answer	Mark
7(a)(iv)	4	1

Question number	Answer	Mark
7(b)(i)	An explanation that makes reference to the following points: - incomplete combustion/lack of oxygen (1) - leads to the formation of carbon monoxide (1)	2

Question number	Answer	Mark
7(b)(ii)	It reduces the capacity of blood to transport oxygen	1

Question number	Answer	Additional guidance	Mark
7(c)	An explanation that makes reference to the following points: - nitrogen in the air and oxygen react (1) - at high temperatures (1) - which causes the formation of nitrogen oxide(s) (1) - oxides then react with water (vapour) in the atmosphere to form nitric acid (1)	accept equation and formulae such as NO/NO ₂ /NO _x accept nitrous acid and formulae	4

Total for Question 7 = 13 marks

Question number	Answer	Mark
8(a)	One reaction product is a gas and so escapes from the flask	1

Question number	Answer	Mark
8(b)(i)	Any one of: - balance reading recorded too late - acid concentration greater than recorded	1

Question number	Answer	Mark
8(b)(ii)	Loss in mass directly proportional to acid concentration	1

Question number	Answer	Additional guidance	Mark
8(c)	An explanation that makes reference to the following two points: - more particles in the same volume (1) - so collide more frequently (with malachite) (1)	accept particles closer together	2

Total for Question 8 = 5 marks

Question number	Answer	Mark
9(a)	A description that makes reference to five of the following points: • crude oil is heated/vaporised (1) • the vapour enters the lower part of the column (1) • there is a temperature gradient up the column (1) • the vapour in the diesel fraction rises up the column until it condenses (1) • at a height where its boiling point is lower than the temperature in the column (1) • so the diesel fraction is removed (1)	5

Question number	Answer	Additional guidance	Mark
9(b)	An explanation that makes reference to the following three points: • dodecane contains hydrogen and carbon (1) • only/and no other elements (1) • and contains only single bonds (1)	accept does not contain double bonds/multiple bonds	3

Question number	Answer	Mark
9(c)	C	1

Question number	Answer	Mark
9(d)	C ₈ H ₁₈	1

Question number	Answer	Additional guidance	Mark
9(e)(i)	Ultraviolet radiation	accept ultraviolet light	1

Question number	Answer	Mark
9(e)(ii)	HCl	1

Question number	Answer	Additional guidance	Mark
9(e)(iii)	- All 6 atoms with a dot and cross representing each bonding pair of electrons (1) 3 lone pairs of electrons on Cl and none on any of the H atoms (1)	accept 2 dots or 2 crosses for each bond accept any combination of dots and crosses	2

Question number	Answer	Mark
9(e)(iv)	Substitution	1

Question number	Answer	Mark
9(f)(i)	D	1

Question number	Answer	Mark																				
9(f)(ii)	- Dividing percentages by atomic masses (1) - Dividing results by smallest value OR obtaining ratio (1) - Writing empirical formula (1) Example calculation: <table><tr><td>C</td><td>H</td><td>Br</td><td>O</td></tr><tr><td><u>25.9</u></td><td><u>5.0</u></td><td><u>57.6</u></td><td><u>11.5</u></td></tr><tr><td>12</td><td>1</td><td>80</td><td>16</td></tr><tr><td>2.16</td><td>5.0</td><td>0.72</td><td>0.72</td></tr><tr><td>3</td><td>7</td><td>1</td><td>1</td></tr></table> C₃H₇BrO accept symbols in any order	C	H	Br	O	<u>25.9</u>	<u>5.0</u>	<u>57.6</u>	<u>11.5</u>	12	1	80	16	2.16	5.0	0.72	0.72	3	7	1	1	3
C	H	Br	O																			
<u>25.9</u>	<u>5.0</u>	<u>57.6</u>	<u>11.5</u>																			
12	1	80	16																			
2.16	5.0	0.72	0.72																			
3	7	1	1																			

Total for Question 9 = 19 marks

Question number	Answer	Mark
10(a)	- Increment in volume smaller/more precise (1) - Avoids refilling the measuring cylinder (1)	2

Question number	Answer	Additional guidance	Mark
10(b)			
	thermometer reading at end/°C	(26.8)	1 mark for temperature at start 1 mark for temperature rise consequential on readings
	thermometer reading at start/°C	18.7	
	temperature rise/°C	8.1	
			2

Question number	Answer	Mark
10(c)(i)	29.5	1

Question number	Answer	Mark
10(c)(ii)	20.8	1

Question number	Answer	Mark
10(d)	- Calculation of volume/mass of mixture - Calculation of temperature increase - Substitution of values into $q=mc\Delta T$ - Calculation of heat energy released with unit Example calculation: $20.0 + 20.0 = 40.0 \text{ (cm}^3\text{)} (1)$ $30.0 - 18.5 = 11.5 \text{ (}^\circ\text{C)} (1)$ $q = 40.0 \times 4.2 \times 11.5 (1)$ $q = 1900 \text{ J} (1) \text{ (accept 1932 J)}$	4

Question number	Answer	Mark
10(e)	- Setting out of ΔH calculation - Division by 1000 to obtain answer in kJ/mol Example calculation: $1600 \div 0.040 (1)$ $= -40 \text{ (kJ/mol)} (1)$	2

Total for Question 10 = 12 marks

Question number	Answer	Mark									
11(a)	1 mark for each box completed correctly <table border="1"> <thead> <tr> <th>Reactants</th><th>Name of salt formed</th><th>Other product(s)</th></tr> </thead> <tbody> <tr> <td>(zinc + hydrochloric acid)</td><td>zinc chloride</td><td>hydrogen</td></tr> <tr> <td>(calcium carbonate + nitric acid)</td><td>calcium nitrate</td><td>water + carbon dioxide</td></tr> </tbody> </table>	Reactants	Name of salt formed	Other product(s)	(zinc + hydrochloric acid)	zinc chloride	hydrogen	(calcium carbonate + nitric acid)	calcium nitrate	water + carbon dioxide	4
Reactants	Name of salt formed	Other product(s)									
(zinc + hydrochloric acid)	zinc chloride	hydrogen									
(calcium carbonate + nitric acid)	calcium nitrate	water + carbon dioxide									

Question number	Answer	Mark
11(b)(i)	• Use excess aluminium hydroxide (1) • Stir (thoroughly) (1)	2

Question number	Answer	Mark
11(b)(ii)	To remove unreacted aluminium hydroxide/solid	1

Question number	Answer	Mark
11(b)(iii)	Any one of: • leave in a warm place (1) • use filter paper or paper towel (1)	1

Question number	Answer	Mark
11(c)	• Calculation of M_r of aluminium hydroxide • Calculation of amount of aluminium hydroxide • Reference to 2 : 3 ratio in equation AND statement that sulfuric acid is in excess Example calculation: $27 + (3 \times 17) = 78$ (1) $3.9 \div 78 = 0.05 \text{ mol}$ (1) This is more than $3/2$ times amount of aluminium hydroxide, so sulfuric acid is in excess (1) (accept other valid methods of calculation)	3

Question number	Answer	Mark
11(d)	Calculation of M_r of aluminium sulfate setting out calculation of mass final answer Example calculation: $(27 \times 2) + (32 \times 3) + (16 \times 12) = 342$ (1) $\text{mass} = 342 \times 0.25$ (1) 85.5 g (1)	3

Question number	Answer	Additional guidance	Mark
11(e)	• Calculation of amount of lead(II) nitrate • Percentage method • Percentage answer Example calculation: $209 \div 331 = 0.631 \text{ mol}$ (1) $\frac{0.631 \times 100}{0.75}$ (1) = 84% (1)	allow full credit for calculations using masses	3

Total for Question 11 = 17 marks

TOTAL FOR PAPER = 110 MARKS