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 (cm^3) (1) 100 + 10 + 80 = 190 (cm^3) (1) (37 × 100) ÷ 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 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**Rb + **2**H_2O → **2**RbOH + 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_8H_{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: C: 25.9 / 12 = 2.16 : 3 H: 5.0 / 1 = 5.0 : 7 Br: 57.6 / 80 = 0.72 : 1 O: 11.5 / 16 = 0.72 : 1 C_3H_7BrO accept symbols in any order	**3**

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) thermometer reading at start/°C: 18.7 temperature rise/°C: 8.1	1 mark for temperature at start 1 mark for temperature rise consequential on readings	**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 (cm^3) (1) 30.0–18.5 = 11.5 (°C) (1) q = 40.0 × 4.2 × 11.5 (1) q = 1900 J (1) (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 ÷ 0.040 (1) = −40 (kJ/mol) (1)	**2**

Total for Question 10 = 12 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>11(a)</td><td>1 mark for each box completed correctly

<table>
<tr><th>Reactants</th><th>Name of salt formed</th><th>Other product(s)</th></tr>
<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>
</table>
</td><td>4</td></tr>
</table>

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 × 17) = 78 (1) 3.9 ÷ 78 = 0.05 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 × 2) + (32 × 3) + (16 × 12) = 342 (1) mass = 342 x 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 ÷ 331 = 0.631 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