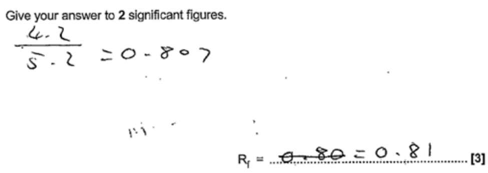
Mark scheme – Purity and Separating Mixtures (F)

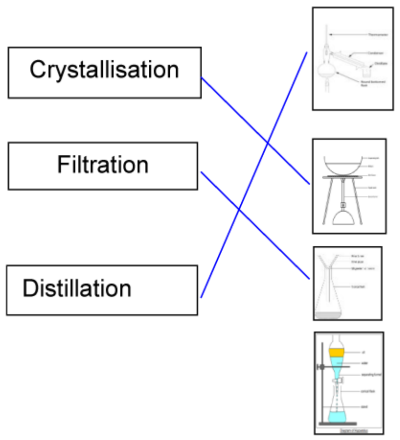
Question			Answer/Indicative content	Marks	Guidance
1			B	1 (AO2.1)	
			Total	**1**	
2			B	1 (AO2.1)	
			Total	**1**	
3			D	1 (AO1.2)	
			Total	**1**	
4			C	1 (AO 2.1)	**<u>Examiner's Comments</u>** D was the most common incorrect response.
			Total	**1**	
5			B	1 (AO 2.2)	**<u>Examiner's Comments</u>** Many candidates added the relative masses of one of each atom and answered A.
			Total	**1**	
6		i	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 120 (tonnes) award 3 marks** M_r of NH_3 = 17 **AND** M_r of NH_4NO_3 = 80 ✓ Mass of ammonium nitrate = $\frac{80}{17}$ x 25.5 / 1.5 x 80 ✓ = 120 (tonnes) ✓	3 (AO2.1)	**ALLOW** ECF from incorrect RMMs
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 10(g) award 2 marks** Actual mass $= \frac{80 \times 12.5}{100}$ ✓ = 10 (g) ✓	2 (AO1.2) (AO2.2)	**ALLOW** % yield = (am ÷ pm) x 100 **OR** 80 = (am ÷ 12.5) x 100 for 1 mark if no other mark awarded
			Total	**5**	
7	a	i	Condenser ✓	1 (AO1.2)	

		ii	Distillation ✓	1 (AO1.1)	**DO NOT ALLOW** fractional
		iii	Add thermometer ✓ Water goes in at the bottom (of condenser) **OR** water comes out at the top (of condenser) ✓	2 (AO2 × 3.3b)	**ALLOW** take out the funnel
	b		Mass of **M**$_3$ = 164 – (31 + 16 × 4) = 69 ✓ Mass of **M** = 69/3 = 23 ✓ **M** = sodium **OR** Na ✓	3 (AO2.2)	**ALLOW** metal closest to calculated **M** by **ECF**
			Total	**7**	
8	a		Ink dissolves in solvent ✓	1 (AO1.1)	**ALLOW** Pencil will not dissolve in solvent **ALLOW** so it doesn't move (with the solvent) / doesn't mix with the spots / solvent / colours in ink don't separate / ink has colours in it / ink would run
	b		Circle / dot drawn on start line in diagram ✓	1 (AO2.2)	
	c		A ✓	1 (AO3.2a)	
	d		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 0.62 award 3 marks** 3.7/6 ✓ = 0.61666…… ✓ = 0.62 (2 sig. figs) ✓	3 (AO2 × 2.2 1.2)	**ALLOW** 3.7 ± 0.1
			Total	**6**	
9			*Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** Correctly names the acid and the base used in the neutralisation reaction. **AND** Method can be followed to make a pure, dry sample of potassium chloride. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*	6 (AO1.1 ×2 2.2 ×2 3.3a ×2)	**AO1.1 Demonstrates knowledge and understanding of neutralisation reactions** • base neutralises the acid • acid + base → salt + water • potassium chloride is a salt • potassium chloride is neutral **AO2.1 Application of knowledge and understanding related to making a salt by neutralisation** • acid used is hydrochloric acid

			Level 2 (3–4 marks) Correctly names the acid and the base used in the neutralisation reaction. **OR** Method can be followed to make a salt sample. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Method includes adding acid to base. **OR** Correctly names either the acid or the base used in the neutralisation reaction. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		• base used is potassium hydroxide / potassium oxide / potassium carbonate • pH paper / pH probe is used to show solution made is neutral **AO3.3 Analyse of information and ideas to develop experimental procedures** • pH probe will not contaminate the solution • evaporate some of the water to form crystals • leave the crystals to dry / dry crystals in an oven
			Total	**6**	
10	a	i	A **AND** D ✓	1 (AO3.1a)	
		ii	**Any two from:** Conducts electricity in molten state ✓ Does not conduct electricity in solid state ✓ High melting point ✓	2 (AO3.2b)	ALLOW dissolve in water
	b	i	Add water (and stir) ✓ Filtration ✓ **B** collects on filter paper ✓	3 (AO3.3a 1.2 3.3a)	
		ii	Distillation **OR** evaporation **OR** heating ✓	2 (AO1.2 3.3a)	**ALLOW** boiling

			Removes water **OR** dries C **OR** removes some water and leave to crystalise ✓		
			Total	**8**	
11	a		Low density **and** idea that aircraft is lightweight / isn't too heavy to fly / less weight to carry / AW ✓ High strength **and** idea that aircraft is less likely to be damaged ✓	2 (AO3.2b)	**DO NOT ALLOW** light / lighter for low density but **ALLOW** so aircraft is light or lighter **Answers must give property and explanation for marks** **BUT ALLOW** 1 mark for low density and high strength / strong**est** if no or only one explanation given **Examiner's Comments** Many candidates discussed the properties without applying them to the specific use of making an aircraft.
	b	i	(Percentage of lithium =) (2 ÷ 10) × 100 = 20(%) ✓	1 (AO3.1a)	**Examiner's Comments** Many calculated the percentage correctly. Incorrect responses included 25%, 2% and 80%.
		ii	Idea that alloy B is only 2.2% lithium / Idea that alloy B is 2.2% lithium but the diagram has 20% lithium / Idea that the % of lithium in the alloy is much smaller than in the diagram / there should be 100 aluminium atoms (and 2 lithium atoms) ✓	1 (AO3.2a)	**ALLOW** ECF from incorrect percentage in (c)(i) **ALLOW** should be more Al atoms / 17.8% too large **IGNORE** references to the relative sizes of the atoms **Examiner's Comments** Higher ability candidates compared their answer to the amount quoted in the table. Many discussed the relative sizes of the atoms, the small numbers in the diagram, the structure or properties of an alloy or omitted the question.
			Total	**4**	
12	a	i	Red and Yellow ✓	1 (AO3.1a)	**BOTH** needed for the mark **Examiner's Comments** Identifying red or yellow rather than both was common, some candidates responded 1849, the date of the paint using all pure dyes.

		ii	Y ✓ All paints are soluble (in Y) / ORA ✓	2 (AO3.1b) (AO3.2b)	**ALLOW** dissolves all 3 colours / forms (clear) solutions **<u>Examiner's Comments</u>** Many candidates chose Y but did not give a creditworthy explanation of their choice. Both X and Y were chosen quite often with solid or clear solvents being a reason for choice.
		iii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.79 award 3 marks** R_f = 41(mm) ÷ 52(mm) / 4.1(cm) ÷ 5.2(cm) ✓ = 0.788 ……✓ = 0.79 (2 sig figs) ✓	3 (AO2.2 ×2) (AO1.2)	**<u>Examiner's Comments</u>** Few candidates measured the distances correctly. Most used their values correctly to calculate a value for R_f and gave the value to 2 significant figures. Some candidates gave an incorrect answer with no working and so working marks could not be given. A small number omitted the question. **Exemplar 5**  Give your answer to **2** significant figures. $\frac{4.2}{5.2} = 0.807$ R_f = ~~0.80~~ = 0.81 [3] The candidate has measured the solvent front correctly but not the spot distance so has not gained marking point one. However, because the candidate has clearly shown their working for the division sum and the correct evaluation, they can gain credit for marking point 2. They have then rounded this value correctly to 2 significant figures and therefore score marking point 3. Had the candidate only written 0.81 in the answer space with no working they would have scored 0.
	b		No (no mark) All the sample paints match the paint in the 1973 painting / chromatogram is the same as the 1973 chromatogram ✓	1 (AO3.2b)	**ALLOW** The blue paint was different in 1849 / blue paint has different R_f to the blue paint used in 1849 / blue paint pure in 1849 / blue paint not pure in sample/it doesn't match 1849 **<u>Examiner's Comments</u>** Many candidates appreciated that the

					laboratory was incorrect but struggled to explain why. A significant number thought the chromatogram matched the paint from 1849.
			Total	**7**	
13		i	900 (^{0}C) ✓	1 (AO3.3a)	**Examiner's Comments** A small but significant number of candidates gave 500°C
		ii	(compound X) consists of one type of particle/one compound/element/substance	1 (AO1.1)	**ALLOW** no other substance mixed with it **Examiner's Comments** The most common incorrect response was the compound containing just one element.
		iii	A pure substance melts at a specific temperature / the line is horizontal / has a single melting temperature ✓	1 (AO2.1)	**ALLOW** A mixture melts over a range of temperatures / the line would not be horizontal **IGNORE** boiling point **Examiner's Comments** Many candidates either did not use the graph to inform their answer or described areas of positive gradient. High melting point was the most common incorrect response, others included: one line and time for melting,
			Total	**3**	
14	a		Use a magnet ✓	1 (AO2.2)	**ALLOW** dissolve sulfur in solvent/xylene **and** filter **ALLOW** sieve **Examiner's Comments** Candidates found this very difficult with filtration and crystallisation being the most common incorrect responses.
	b			3 (AO1.2)	

			If more than one line drawn to apparatus DO NOT award the mark.		
			Total	**4**	
15			negative electrode / cathode – copper deposited (1) positive electrode / anode – anode dissolves / copper ions formed (1)	2	
			Total	**2**	
16	a		During this reaction, the oxidising agent is **oxygen** and the reducing agent is **magnesium** (1)	1	
	b		$2Mg(s)$ (1) + $O_2(g)$ (1) $\longrightarrow$ $2MgO(s)$	2	
			Total	**8**	
17			D	1	
			Total	**1**	
18			C	1	
			Total	**1**	
19			A	1	
			Total	**1**	
20			A	1	
			Total	**1**	
21			B	1	
			Total	**1**	
22			A	1	
			Total	**1**	
23			D	1	
			Total	**1**	
24			Slow evaporation of solution / heat solution over a steam bath (1)	1	
			Total	**1**	
25			B	1	
			Total	**1**	