

1(a)(i)	$\text{Sr}(\text{HCO}_3)_2 \rightarrow \text{SrCO}_3 + \text{CO}_2 + \text{H}_2\text{O}$
1(a)(ii)	M1: radius of cation / M^{2+} increases OR charge density of cation / M^{2+} decreases M2: less polarisation / less distortion of the anion / carbonate ion
1(b)	M1: least soluble $\text{CaF}_2 < \text{SrF}_2 < \text{BaF}_2$ most soluble M2: ΔH_{latt} and ΔH_{hyd} both become less exothermic / less negative M3: ΔH_{hyd} changes less / becomes less exothermic by a smaller extent OR ΔH_{latt} changes more / becomes less exothermic by a larger extent M4: ΔH_{sol} becomes more exothermic / more negative
1(c)(i)	enthalpy change when one mole of gaseous ions dissolve in water to form a solution
1(c)(ii)	M1: ionic radii AND ionic charge M2: (ionic) radii increase / charge density decreases AND ΔH_{hyd} decreases/less exothermic AND less attraction between water molecules and (gaseous) ions OR as ionic charge increases / charge density increases AND ΔH_{hyd} increases/more exothermic AND more attraction between water molecules and (gaseous) ions
1(d)	M1: use of $-2957 / -1926 / -505$ AND $2 \times (-505)$ M2: correct signs and evaluation ΔH_{sol} of $\text{MgF}_2(\text{s}) = -1926 + (2 \times -505) - (-2957) = (+)21 \text{ kJ mol}^{-1}$
1(e)(i)	M1: $K_{\text{sp}} = [\text{Hg}_2^{2+}] [\text{F}^-]^2$ M2: units = $\text{mol}^3 \text{ dm}^{-9}$
1(e)(ii)	$K_{\text{sp}} = 2^2 \times (9.20 \times 10^{-3})^3 = 3.11 \times 10^{-6} \text{ min } 2\text{sf}$

3(a)(i)	two species that differ by one proton / H^+
3(a)(ii)	H_2PO_4^- AND PO_4^{3-}
3(b)(i)	M1: $[\text{H}^+] = 2.51 \times 10^{-4}$ M2: $[\text{CH}_3\text{CH}_2\text{COOH}] = 4.67 \times 10^{-3}$
3(b)(ii)	3.98×10^{-11}
3(b)(iii)	$[\text{HC}\ddot{\text{I}}] = 2.51 \times 10^{-4}$
3(b)(iv)	M1: top box ticked AND weaker acid M2: alkyl group is electron donating M3: O–H bond strengthened / anion is destabilised
3(c)(i)	NaOH AND $\text{CH}_3\text{CH}_2\text{COOH} + \text{OH}^- \rightarrow \text{CH}_3\text{CH}_2\text{COO}^- + \text{H}_2\text{O}$
3(c)(ii)	H_2SO_4 AND conjugate base of $\text{CH}_3\text{CH}_2\text{COOH}$ is not present
3(d)(i)	3.69×10^{-5}
3(d)(ii)	M1: $K_{\text{sp}} = [\text{Mn}^{2+}][\text{OH}^-]^2$ M2: units = $\text{mol}^3 \text{ dm}^{-9}$
3(d)(iii)	2.0×10^{-13}

1(a)(i)	2.12 g
1(a)(ii)	M1 add a (small) volume of (distilled) water (to the small beaker) AND dissolve the solid / $\text{AgNO}_3(\text{s})$ M2 Transfer the solution and washings (using a funnel) AND into a 250 cm^3 volumetric flask. M3 Make up to the (calibration) mark / line with distilled water. AND then invert the (stoppered) flask (several times)
1(b)(i)	$(20(.0) \text{ cm}^3)$ pipette.
1(b)(ii)	barium (ions) could react with chromate (ions).
1(b)(iii)	Potassium chromate(VI) / $\text{K}_2\text{CrO}_4(\text{aq})$ is an irritant / corrosive
1(c)(i)	They are (the only ones that are) concordant.
1(c)(ii)	$\frac{2 \times 0.05}{20.60} \times 100 = 0.48(54\%)$ Correct working must be shown.
1(d)(i)	$20.65 \times 0.05 / 1000 = 0.00103(25)$
1(d)(ii)	$= ((\text{d})(\text{i}) / 2) \times (250 / 20)$ $= (\text{d})(\text{i}) \times 6.25$
1(d)(iii)	M1 $M_r = 1.58 / (\text{d})(\text{ii})$ M2 $x = (M_1 - 208.3) / 18$ AND x must be an integer. Some working must be shown.
1(e)	Heat to drive off water of crystallisation. M1 Apparatus 1 Bunsen burner. 2 Crucible (supported by pipeclay triangle) M2 Measurements 1 Measure mass of crucible (+ lid) (empty). 2 Measure mass crucible (+ lid) + solid before heating 3 Measure mass of crucible (+ lid) + residue (after heating.) M3 Key step in method • Description of heat to constant mass. OR Produce a suitable precipitate using a viable reaction. M1 Apparatus and method • Chooses suitable reagent. • Filter the precipitate. • Wash and (allow to) dry M2 Measurements • Measure mass of hydrated barium chloride used. • Measure mass of precipitate. M3 Key step in method • Description of dry to constant mass.