1(a)(i)	$Sr(HCO_3)_2 \rightarrow SrCO_3 + CO_2 + H_2O$
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 CaF_2 < SrF_2 < 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 × (–505) **M2**: correct signs and evaluation ΔH_{sol} of $MgF_2(s)$ = –1926 + (2 × –505) – (–2957) = (+)21 kJ mol^{-1}
1(e)(i)	**M1:** $K_{sp} = [Hg_2^{2+}] [F^-]^2$ **M2:** units = $mol^3\ dm^{-9}$
1(e)(ii)	$K_{sp} = 2^2 \times (9.20 \times 10^{-3})^3$ = **3.11×10^{-6}** min 2sf

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:** $[H^+] = 2.51 \times 10^{-4}$ **M2:** $[CH_3CH_2COOH] = 4.67 \times 10^{-3}$
3(b)(ii)	3.98×10^{-11}
3(b)(iii)	$[HCl] = 2.51 \times 10^{-4}$
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** $CH_3CH_2COOH + OH^- \rightarrow CH_3CH_2COO^- + H_2O$
3(c)(ii)	H_2SO_4 **AND** conjugate base of CH_3CH_2COOH is not present
3(d)(i)	3.69×10^{-5}
3(d)(ii)	**M1:** $K_{sp} = [Mn^{2+}][OH^-]^2$ **M2:** units = $mol^3\ dm^{-9}$
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 / $AgNO_3$ (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) cm^3) pipette.
1(b)(ii)	barium (ions) could react with chromate (ions).
1(b)(iii)	Potassium chromate(VI) / K_2CrO_4(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 × 0.05 / 1000 = 0.00103(25)
1(d)(ii)	= (**(d)(i)** / 2) *(250 / 20) = **(d)(i)** × 6.25
1(d)(iii)	**M1** M_r = 1.58 / **(d)(ii)** **M2** x= (M1 – 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.