

3(a)(i)	two species that differ by one proton / H ⁺
3(a)(ii)	H ₂ PO ₄ ⁻ AND PO ₄ ³⁻
3(b)(i)	M1: [H ⁺] = 2.51 × 10 ⁻⁴ M2: [CH ₃ CH ₂ COOH] = 4.67 × 10 ⁻³
3(b)(ii)	3.98 × 10 ⁻¹¹
3(b)(iii)	[HC ₂ H ₃ O ₂] = 2.51 × 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 ₃ CH ₂ COOH + OH ⁻ → CH ₃ CH ₂ COO ⁻ + H ₂ O
3(c)(ii)	H ₂ SO ₄ AND conjugate base of CH ₃ CH ₂ COOH 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 <u>distilled</u> 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 ₂ CrO 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 = (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.