5(a)(i)	Co^{2+} = [Ar] $3d^7$ **AND** Co^{3+} = [Ar] $3d^6$
5(a)(ii)	has vacant d orbitals that are energetically accessible
5(a)(iii)	• pink • blue • aqueous Any two [1], all three [2]
5(a)(iv)	$[Co(H_2O)_6]^{2+} + 4HCl \rightarrow [CoCl_4]^{2-} + 6H_2O + 4H^+$ **OR** $[Co(H_2O)_6]^{2+} + 4Cl^- \rightarrow [CoCl_4]^{2-} + 6H_2O$
5(a)(v)	ligand exchange
5(a)(vi)	$[Co(H_2O)_6]^{2+} + 2OH^- \rightarrow Co(OH)_2(H_2O)_4 + 2H_2O$ **OR** $[Co(H_2O)_6]^{2+} + 2OH^- \rightarrow Co(OH)_2 + 6H_2O$
5(b)(i)	**M1:** Nernst equation $E = E^{\ominus} + (0.059 / z) \times \log(\frac{[oxidised]}{[reduced]})$ **M2:** E = –0.28 + (0.059 / 2) × log(0.02)
5(b)(ii)	1.66 V
5(b)(iii)	$3Co + Cr_2O_7^{2-} + 14H^+ \rightarrow 3Co^{2+} + 2Cr^{3+} + 7H_2O$
5(b)(iv)	Co^{2+} / Co, Co^{2+} / Co, $Cr_2O_7^{2-}$ / Cr^{3+}
5(c)	**M1:** moles of cobalt = 0.547 / 58.9 = 0.00929 **M2:** coulombs required = 0.00929 × 96500 × 2 = 1792 **M3:** time required = 1792 / 0.50 = 3584.8 s = 59.7 minutes 3sf