Question	Marking guidance	Mark	AO	Comments
06.1	Burette Because it can deliver variable volumes	1 1	AO3 1b AO2g	
06.2	The change in pH is gradual / not rapid at the end point An indicator would change colour over a range of volumes of sodium hydroxide	1 1	AO3 1a AO3 1a	 Allow indicator would not change colour rapidly / with a few drops of NaOH
06.3	$[H^+] = 10^{-pH} = 1.58 \times 10^{-12}$ $K_w = [H^+]\,[OH^-]$ therefore $[OH^-] = K_w / [H^+]$ Therefore, $[OH^-] = 1 \times 10^{-14}/1.58 \times 10^{-12} = 6.33 \times 10^{-3}$ (mol dm^{-3})	1 1 1	AO2h AO2h AO2h	 Allow 6.31–6.33 × 10^{-3} (mol dm^{-3})
06.4	At this point, $[NH_3] = [H^+]$ Therefore $K_a = \frac{[H^+]^2}{[NH_4^+]}$ $[H^+] = 10^{-4.6} = 2.51 \times 10^{-5}$ $K_a = (2.51 \times 10^{-5})^2/2 = 3.15 \times 10^{-10}$ (mol dm^{-3})	 1 1 1	 AO2f AO2f AO2f	 Allow 3.15–3.16 × 10^{-10} (mol dm^{-3})
06.5	When $[NH_3] = [NH_4^+]$, $K_a = [H^+]$ therefore $-\log K_a = -\log [H^+]$ Therefore pH = $-\log_{10}(3.15 \times 10^{-10}) = 9.50$	1 1	AO2h AO2h	Answer using alternative value M2 pH = $-\log_{10}(4.75 \times 10^{-9}) = 8.32$ Allow consequential marking based on answer from 6.4