A/B II Written Response Key:

1.

5. **(5 marks)**

Calculate the initial concentration of a KF salt solution that has a pH = 8.65 .
Begin by writing the equation for the predominant equilibrium reaction.

Solution:

For Example:

	$F^-(aq)$	+ $H_2O(\ell)$ ⇄	$HF(aq)$	+	$OH^-(aq)$	← 1 mark
[I]	x		0		0	
[C]	-4.47×10^{-6}		$+4.47 \times 10^{-6}$		$+4.47 \times 10^{-6}$	
[E]	$x - 4.47 \times 10^{-6}$		4.47×10^{-6}		4.47×10^{-6}	← 1 mark

↑

pOH = 5.35
pH = 8.65

(it may be assumed that 4.47×10^{-6} is negligible) ← 1 mark

$$K_b = \frac{K_w}{K_a} = \frac{1.0 \times 10^{-14}}{3.5 \times 10^{-4}} = 2.86 \times 10^{-11}$$

$$K_b = \frac{[HF][OH^-]}{[F^-]}$$

$$2.86 \times 10^{-11} = \frac{(4.47 \times 10^{-6})(4.47 \times 10^{-6})}{x}$$ ← 1 mark

$$x = 0.70\,M = [F^-] = [KF]$$ ← 1 mark

2.

5. **(5 marks)**

Calculate the pH of a 0.35 M solution of the salt ammonium bromide.
Begin by writing the equation for the predominant equilibrium.

Solution:

For Example:

	$NH_4^+(aq)$	+ $H_2O(\ell)$ ⇄	$H_3O^+(aq)$	+	$NH_3(aq)$	← 1 mark
[I]	0.35		0		0	
[C]	$-x$		$+x$		$+x$	
[E]	$0.35 - x$		x		x	← 1 mark

(assume x is negligible)

$$K_a = \frac{[H_3O^+][NH_3]}{[NH_4^+]}$$

$$5.6 \times 10^{-10} = \frac{x^2}{0.35}$$ ← 1 mark

$$x = [H_3O^+] = 1.4 \times 10^{-5}\,M$$ ← 1 mark

pH = 4.85 ← 1 mark

3.

6. A sample of the strong acid HCl(aq) is titrated with a sample of $NH_3(aq)$, a weak base. Write the formula, complete ionic and net ionic equations for the titration reaction. **(3 marks)**

Solution:

For Example:

$HCl(aq) + NH_3(aq) \rightarrow NH_4Cl(aq)$ ← **1 mark**

$H^+(aq) + Cl^-(aq) + NH_3(aq) \rightarrow NH_4^+(aq) + Cl^-(aq)$ ← **1 mark**

$H^+(aq) + NH_3(aq) \rightarrow NH_4^+(aq)$ ← **1 mark**

4.

4. Describe **two** lab tests and how their outcomes could be used to distinguish between a strong acid and a weak acid of equal molar concentrations. **(4 marks)**

Solution:

For Example:

(Any **two** of the following for **4 marks**.)

Test: Electrical conductivity

Outcome: Strong acid has a greater conductivity than the weak acid.

Test: Reaction with Mg

Outcome: Strong acid has a greater reaction rate than the weak acid.

Test: Compare pH using a pH metre

Outcome: Strong acid has a lower pH than the weak acid.