Marks

- Find the concentration of H_3O^+ in a 0.60 M aqueous solution of nitrous acid. The acid dissociation constant of HNO_2 is $K_a = 7.1 \times 10^{-4}$ M. 2

The reaction table is:

	HNO_2	H_2O	$\rightleftharpoons$	H_3O^+	NO_2^-
initial	**0.60**	**large**		**0**	**0**
change	**$-x$**	**negligible**		**$+x$**	**$+x$**
final	**$0.60 - x$**	**large**		**x**	**x**

The equilibrium constant K_a is given by:

$$K_a = \frac{[H_3O^+(aq)][NO_2^-(aq)]}{[HNO_2(aq)]} = \frac{x^2}{0.60 - x} = 7.1 \times 10^{-4}$$

K_a is very small compared to the initial concentration of HNO_2 so that $0.60 - x \sim 0.60$ and so:

$$x^2 \sim (7.1 \times 10^{-4}) \times (0.60) \text{ so } x = [H_3O^+(aq)] = x = 0.021 \text{ M}$$

Answer: **0.021 M**

- An aqueous solution of a weak acid has $[H_3O^+] = 2.54 \times 10^{-4}$ M. Find the pH and pOH of the solution. 1

Using $pH = -\log_{10}([H_3O^+(aq)])$ and $pH + pOH = 14.00$:

$pH = -\log_{10}(2.54 \times 10^{-4}) = 3.60$

$pOH = 14.00 - 3.60 = 10.40$

pH = **3.60**	pOH = **10.40**

- Ammonia, NH_3, is a Brønsted-Lowry base and a Lewis base, but not an Arrhenius base. Why? 3

A Brønsted-Lowry base is a proton (H^+) acceptor: $NH_3 + H^+ \rightleftharpoons NH_4^+$

A Lewis base is a species that can donate a lone pair: $:NH_3 + H^+ \rightleftharpoons NH_4^+$

An Arrhenius base is one that *contains* OH^- ions that are released on dissolution in water. Ammonia *generates* OH^- ions in its reaction with water but does not contain them in its formula and hence it is not an Arrhenius base.