- A 300.0 mL solution of HCl has a pH of 1.22. Given that the pK_a of iodic acid, HIO_3, is 0.79, how many moles of sodium iodate, $NaIO_3$, would need to be added to this solution to raise its pH to 2.00? **3**

Using $pH = -\log_{10}[H^+(aq)]$,

$$[H^+(aq)]_{initial} = 10^{-1.22} = 0.060 \text{ M}$$

$$[H^+(aq)]_{final} = 10^{-2.00} = 0.010 \text{ M}$$

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The change of (0.060 – 0.010 M) = 0.050 M occurs due to the reaction with IO_3^-(aq) to produce HIO_3(aq). If $[IO_3^-(aq)] = x$, the reaction table is:

	$H^+(aq)$ +	$IO_3^-(aq)$	⇌	$HIO_3(aq)$
initial	**0.060**	x		**0**
change	**-0.050**	**-0.050**		**+0.050**
final	**0.010**	x **– 0.050**		**0.050**

As $pK_a = 0.79 = -\log_{10}K_a$:

$$K_a = \frac{[H^+(aq)][IO_3^-(aq)]}{[HIO_3(aq)]} = \frac{(0.010)\times(x - 0.050)}{0.050} = 10^{-0.79}$$

Thus, $x = 0.86 \text{ M} = [IO_3^-(aq)]_{initial}$. This concentration corresponds to a 300.0 mL solution so the number of moles that have been added is:

number of moles = concentration × volume
= (0.86 M) × (0.3000 L) = 0.26 mol

Answer: **0.26 mol**