- 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**

As pH = $-\log_{10}([H_3O^+(aq)]$,

$$[H_3O^+(aq)]_{initial} = 10^{-1.22} = 0.0600 \text{ and } [H_3O^+(aq)]_{final} = 10^{-2.00} = 0.0100$$

The reaction table is:

	$IO_3^-(aq)$	$H_3O^+(aq)$	$\rightleftharpoons$	HIO_3	H_2O
initial	**x**	**0.0600**		**0**	**large**
final	**x – 0.0500**	**0.0100**		**0.0500**	**large**

The solution contains a weak acid (HIO_3 and its conjugate base (IO_3^-). It is a buffer and can be treated using the Henderson-Hasselbalch equation,

$$pH = pK_a + \log_{10}\left(\frac{[base]}{[acid]}\right)$$

$$2.00 = 0.79 + \log_{10}\left(\frac{(x - 0.0500)}{0.0500}\right)$$

$$x = 0.865 \text{ M}$$

This concentration is present in 300.0 mL of solution so the number of moles of IO_3^- which has been added is,

$$\text{number of moles} = \text{concentration} \times \text{volume} = 0.865 \times 0.3000 = 0.260 \text{ mol}$$

Answer: **0.260 mol**