



# Titration

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# How to Build an ICE Table

## The Basics:

- An ICE Table is used to find concentrations at equilibrium and the equilibrium constant (K)
- The values used in an ICE Table must be concentrations, meaning the units are all molarity (M)
- Here is what each letter in ICE represents:

I = Initial concentration

C = Change in concentration

E = concentration when the reaction is at Equilibrium

**H<sub>2</sub>O is excluded in an ICE Table**

## Generic Template of an ICE Table

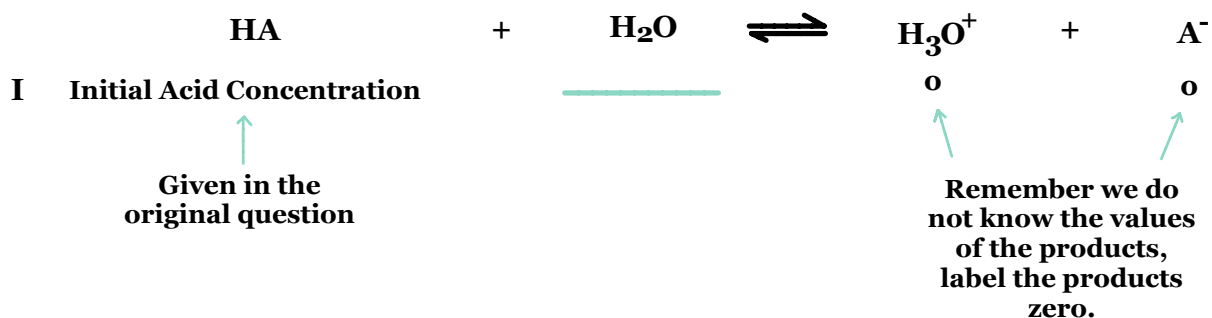
### Balanced Chemical Equation:

	HA	+	H <sub>2</sub> O	⇌	H <sub>3</sub> O <sup>+</sup>	+	A <sup>-</sup>
I	Initial Acid Concentration		_____		0		0
C	-x		_____		+x		+x
E	Initial Acid Concentration - x		_____		x		x

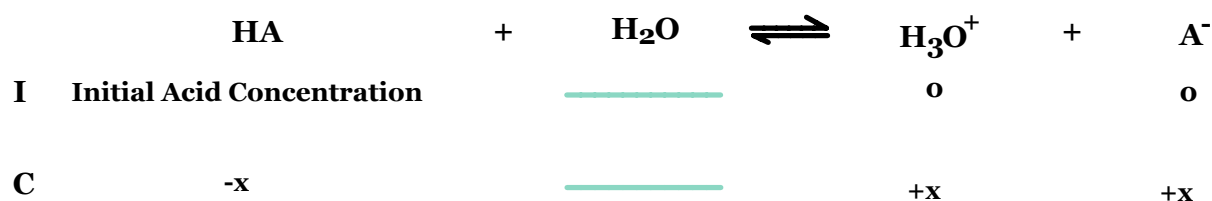
# How to Build an ICE Table

## Steps for building an ICE Table

**Step 1** Start with adding initial concentration values to the first line.  $\text{H}_2\text{O}$  is excluded in an ICE Table

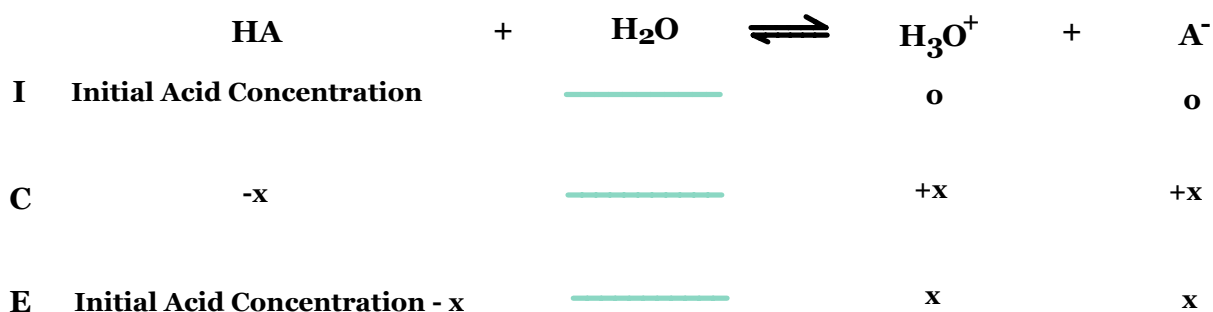


**Step 2** Place  $-x$  for the reactants and  $+x$  for the products



Note:  $x$  depends on the coefficients in the balanced chemical equation, if there was a 2 coefficient in front of  $\text{HA}$ , for example  $2 \text{HA}$  then the change would be  $2x$

**Step 3** Add rows I and C together to get row E



# How to Build an ICE Table Example

Calculate the pH at different volumes of KOH in a titration of 40.0 mL of 0.100 M HCOOH ( $K_a = 1.80 \times 10^{-4}$ ) with 0.100 M KOH.

## Steps for building an ICE Table

**Step 1** Start with adding initial concentration values to the first line.  $H_2O$  is excluded in an ICE Table



I	0.100	—	0	0
	↑		↑	↑
	Given in the original question		Remember we do not know the values of the products, label the products zero.	

**Step 2** Place -x for the reactants and +x for the products



I	0.100	—	0	0
C	-x	—	+x	+x

**Step 3** Add rows I and C together to get row E



I	0.100	—	0	0
C	-x	—	+x	+x
E	0.100 - x	—	x	x