



## The pH Scale

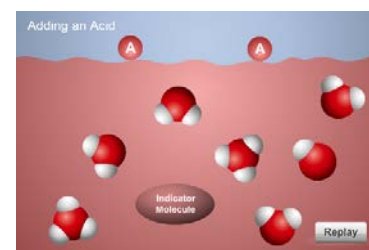
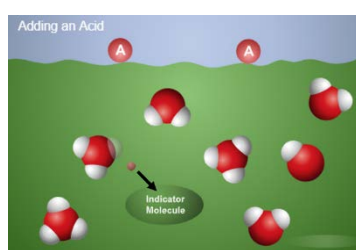
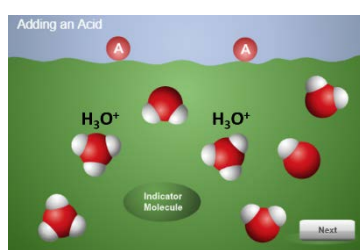
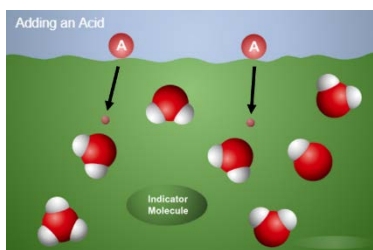
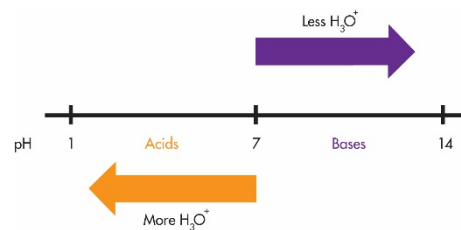
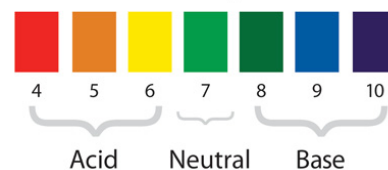
The famous pH scale is actually a measure of the concentration of  $\text{H}_3\text{O}^+$  ions in a sample of water. Because of the way the pH scale is set up, the higher the concentration of  $\text{H}_3\text{O}^+$  ions, the lower the number on the pH scale. When water is neutral (neither acid or base) it has a pH of 7. If a solution has more  $\text{H}_3\text{O}^+$  than  $\text{OH}^-$ , it is an acid and will measure a pH *lower* than 7. If a solution has less  $\text{H}_3\text{O}^+$  than  $\text{OH}^-$ , it is a base and will measure a *higher* number on the pH scale.

## Acids Donate Protons to Water

Acids and bases are substances that interact with water and with a pH indicator in a special way. When an acid is added to water, protons from the acid molecules react with some of the water molecules.

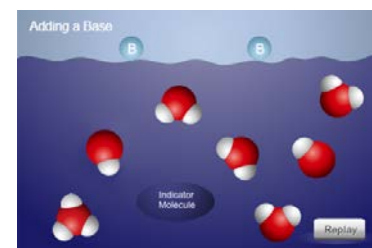
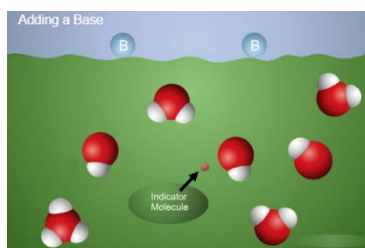
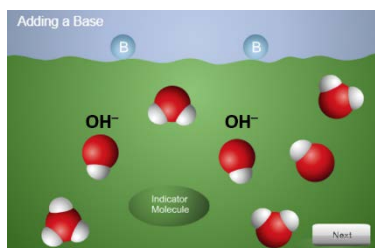
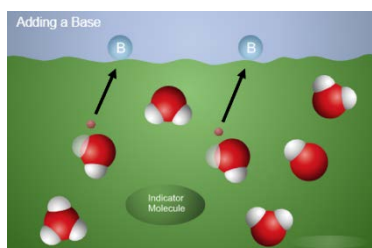
Since these water molecules now have an extra positive charge, they become positively charged ions ( $\text{H}_3\text{O}^+$ ) and make the water acidic. A proton from these  $\text{H}_3\text{O}^+$  ions is transferred to the indicator which causes a shape change of the indicator molecule and a color change.

Universal Indicator pH Color Chart



## Bases Accept Protons from Water

When a base is added to water, some water molecules lose a proton to the base. Since these water molecules now have one fewer positive charge, they become negatively charged ions ( $\text{OH}^-$ ). These  $\text{OH}^-$  ions react with the  $\text{H}_3\text{O}^+$  ions to form water. This reduces the concentration of  $\text{H}_3\text{O}^+$  and makes the water basic. A proton from the indicator is also transferred to these  $\text{OH}^-$  ions which causes a shape change of the indicator molecule and a color change.



**Note:** The animation used in the lesson is a much simpler version and does not show these steps in this much detail. The animation in the lesson shows an acid donating a proton directly to the indicator causing a shape change and color change.

It also shows a base accepting a proton directly from the indicator, resulting in the indicator changing shape and color.