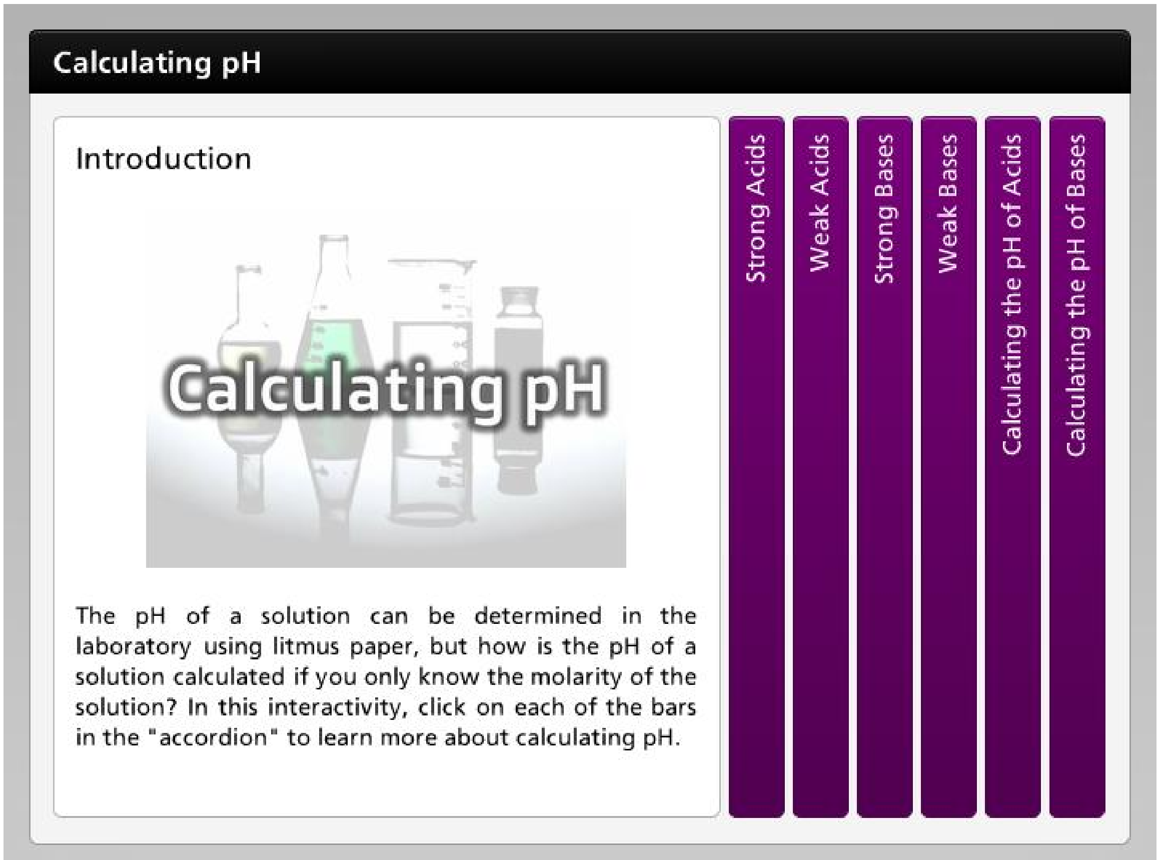
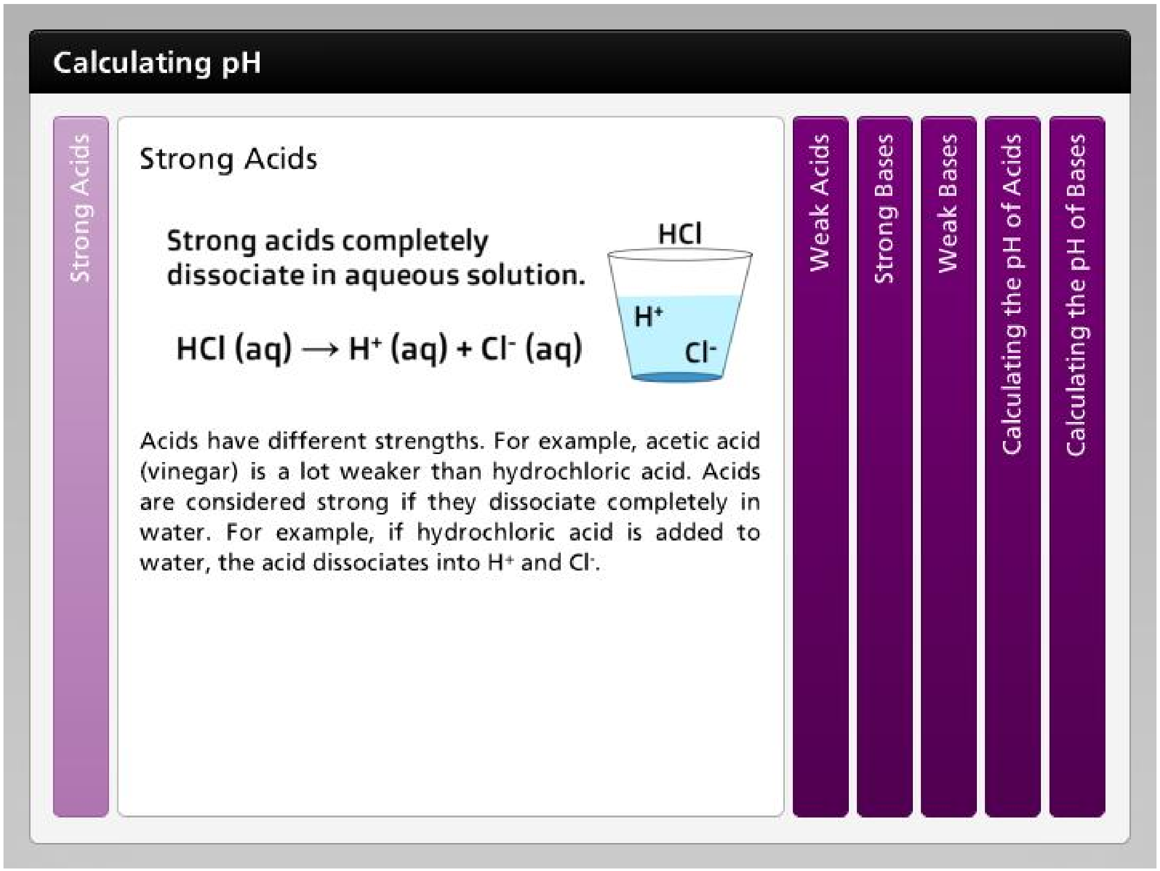
Module 11: Acid/Bases, Neutralization, and Redox Reactions
Topic 1 Content: Calculating pH Notes

Introduction



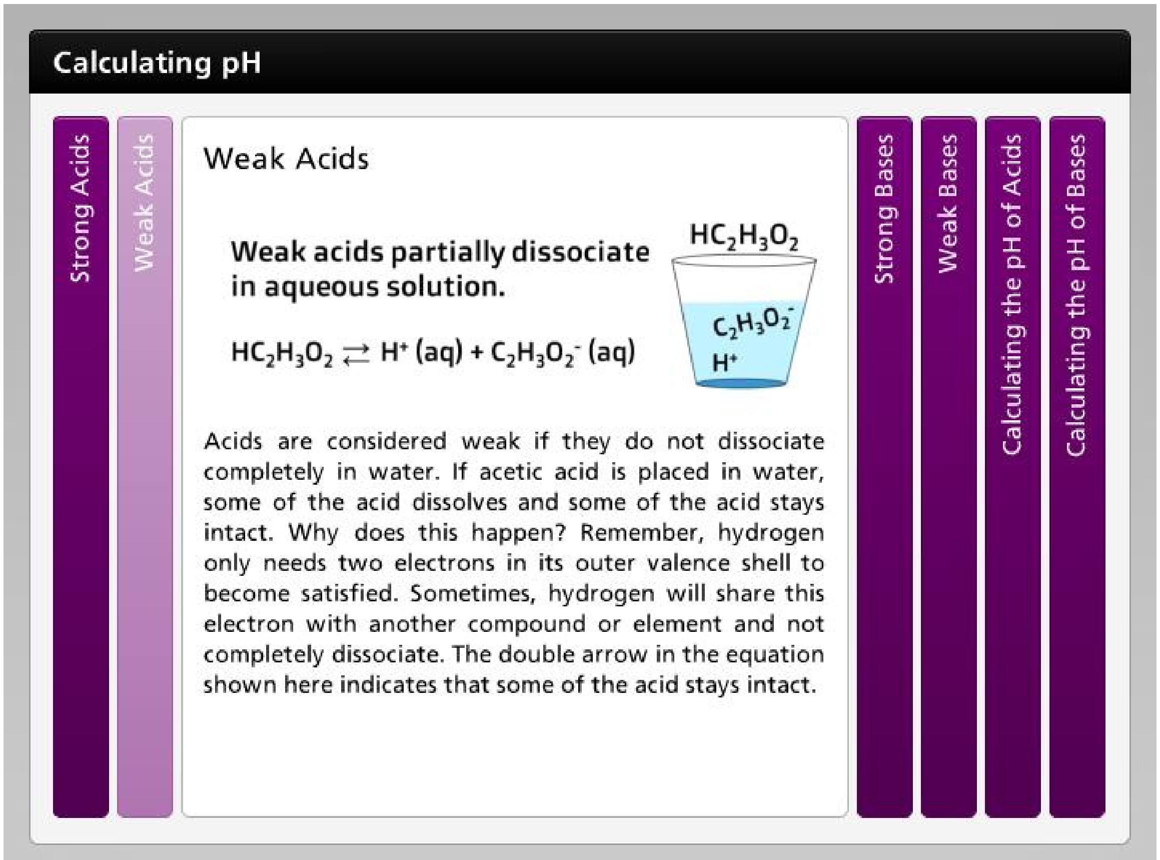
The pH of a solution can be determined in the laboratory using litmus paper, but how is the pH of a solution calculated if you only know the molarity of the solution? In this interactivity, click on each of the bars in the "accordion" to learn more about calculating pH.

Strong Acids



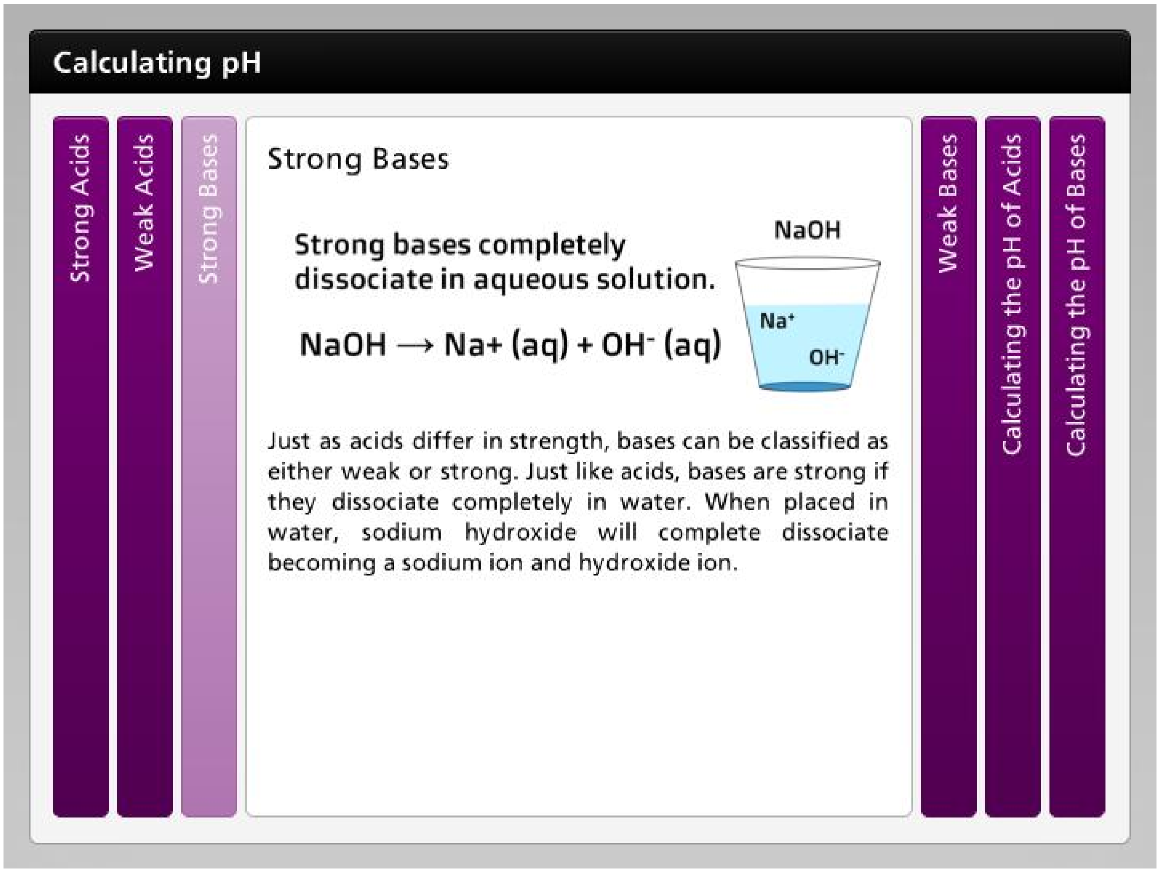
Acids have different strengths. For example, acetic acid (vinegar) is a lot weaker than hydrochloric acid. Acids are considered strong if they dissociate completely in water. For example, if hydrochloric acid is added to water, the acid dissociates into H^+ and Cl^-.

Weak Acids



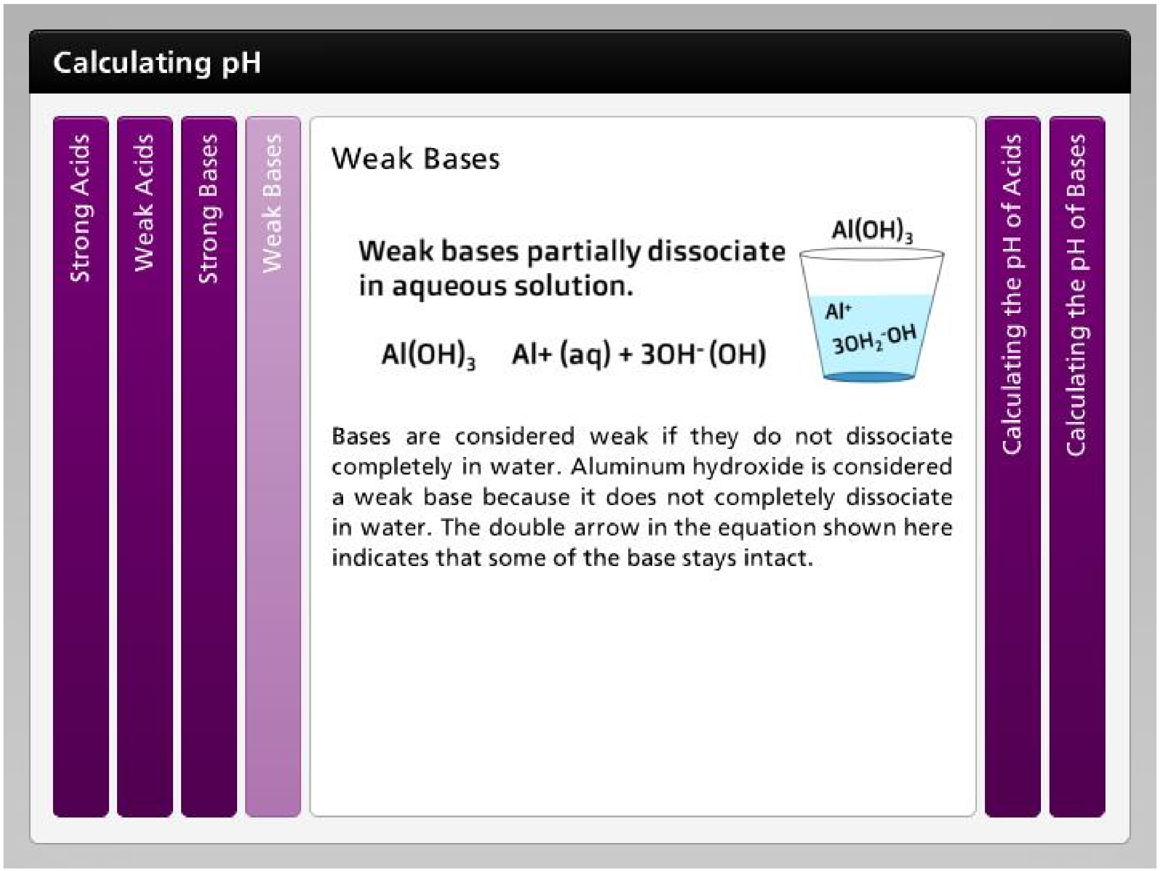
Acids are considered weak if they do not dissociate completely in water. If acetic acid is placed in water, some of the acid dissolves and some of the acid stays intact. Why does this happen? Remember, hydrogen only needs two electrons in its outer valence shell to become satisfied. Sometimes, hydrogen will share this electron with another compound or element and not completely dissociate. The double arrow in the equation shown here indicates that some of the acid stays intact.

Strong Bases



Just as acids differ in strength, bases can be classified as either weak or strong. Just like acids, bases are strong if they dissociate completely in water. When placed in water, sodium hydroxide will complete dissociate becoming a sodium ion and hydroxide ion.

Weak Bases



Bases are considered weak if they do not dissociate completely in water. Aluminum hydroxide is considered a weak base because it does not completely dissociate in water. The double arrow in the equation shown here indicates that some of the base stays intact.

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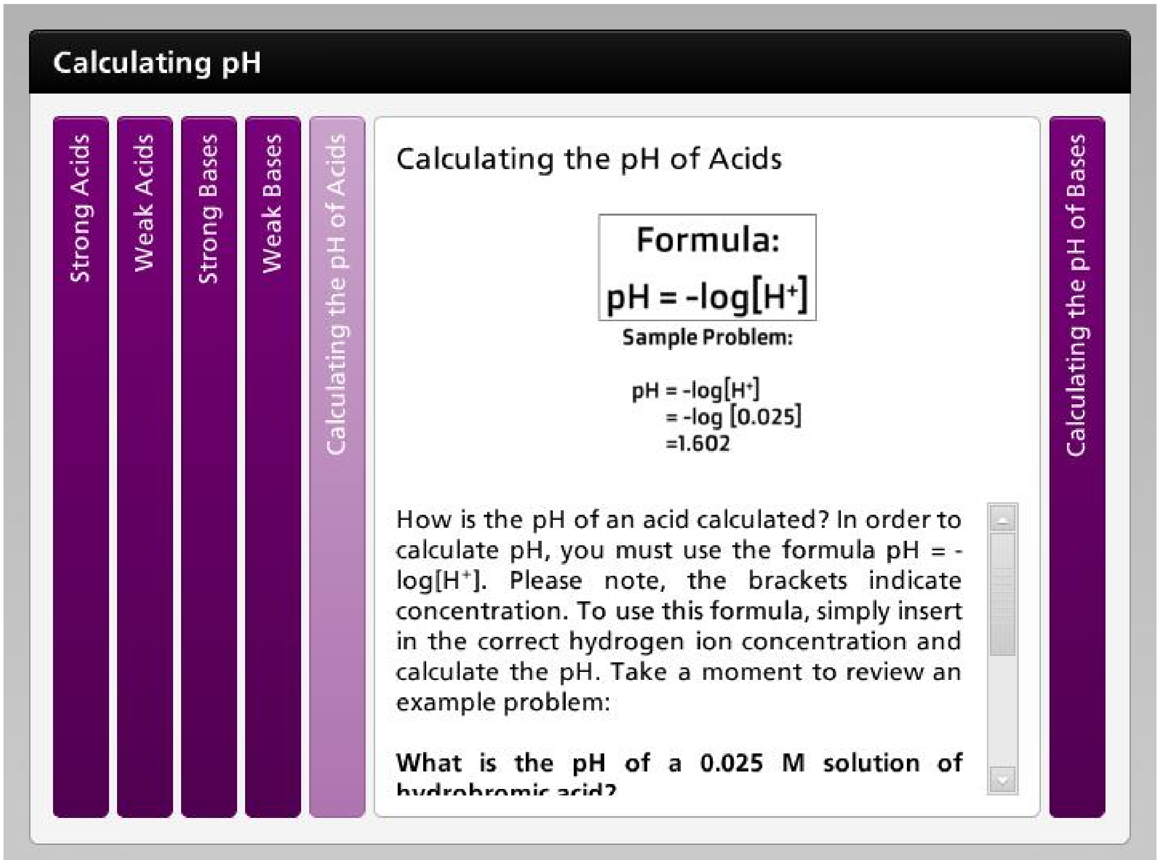
Calculating the pH of Acids

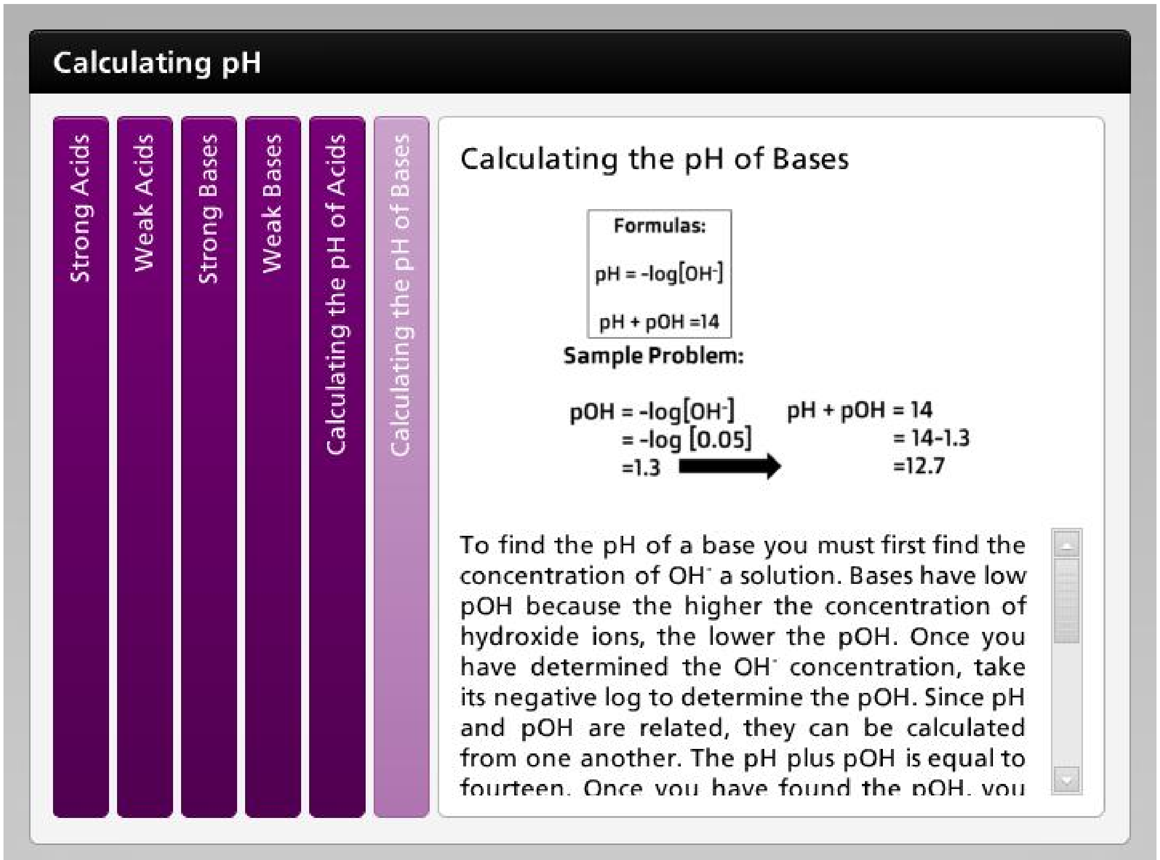


How is the pH of an acid calculated? In order to calculate pH, you must use the formula pH = -log[H^+]. Please note, the brackets indicate concentration. To use this formula, simply insert in the correct hydrogen ion concentration and calculate the pH. Take a moment to review an example problem:

What is the pH of a 0.025 M solution of hydrobromic acid?

Hydrobromic acid, or HBr, is a strong acid and will completely dissociate in water to form H^+ and Br^-. This means that for every mole of HBr, there is one mole of H^+. The concentration of H^+ remains exactly the same. To calculate the pH, take the negative log of 0.025. The pH of a 0.025 M solution of hydrobromic acid is 1.602.

Calculating the pH of Bases



To find the pH of a base you must first find the concentration of OH^- a solution. Bases have low pOH because the higher the concentration of hydroxide ions, the lower the pOH. Once you have determined the OH^- concentration, take its negative log to determine the pOH. Since pH and pOH are related, they can be calculated from one another. The pH plus pOH is equal to fourteen. Once you have found the pOH, you can use this formula to determine pH.

Imagine having to find the pH of a 0.05 M solution of potassium hydroxide. Potassium hydroxide is a strong base that completely dissociates in water to K^+ and OH^-. For every mole of KOH, there is one mole of OH^-. This means that the concentration of OH^- is 0.05. Calculate the pOH by taking the negative log of 0.05. The pOH is equal to 1.3. Since pH and pOH are related, the pH of this solution is equal to 14 minus 1.3. The pH of this solution is 12.7.