

The Chemistry of Coffee

Senior High Chemistry

Lesson 2

Chemistry and Coffee– Introduction to Acids and Coffee Flavor

~40 minutes

Introduction:

Acidity is a desirable characteristic of coffee. It is the sensation of dryness that the coffee produces under the edges of your tongue and on the back of your palate. It provides a sharp, bright, vibrant quality. Without sufficient acidity, the coffee will tend to taste flat. Acidity should not be confused with sour, which is an unpleasant, negative flavor characteristic. The acidity of coffee is determined by the type of bean, where the bean is grown, and how much the bean is roasted. Green (raw) coffee beans have very high acid content, they are very acidic. Roasting (cooking) beans causes thousands of chemical reactions to happen and in this process, many of the acids are transformed into other molecules. So, light roasts (not cooked for very long) have more acids in them than dark roasts (cooked for much longer). Because different acids provide different flavor profiles, the amount of acid in a bean and then in the cup of coffee that is made from it, will differ depending on the roast (because it changes the types and amounts of acids).

1. Read the introduction. Explain the connection between coffee and acids.

Watch the video “pH and pOH” by Crash Course Chemistry <https://www.youtube.com/watch?v=LS67vS10Q5Y>

2. Define pH: A measure of _____.
3. What is the mathematical formula for pH? _____
4. What are the two products of the chemical reaction where water molecules are broken apart (this is also known as the dissociation of water)? [around 3:50ish]
 - a. Name: _____ & Chemical Formula: _____
 - b. Name: _____ & Chemical Formula: _____
5. What is K_w ?
6. What is K_w equal to?
7. What is the pH of water because it is neutral? _____
8. When the hydrogen ion concentration goes up, the pH gets _____.
9. What is the entire range of the pH scale? _____
 - a. Acids have a pH ranging from _____ to _____.
 - i. List 5 examples of acids from the diagram.
 - b. Bases have a pH ranging from _____ to _____.
 - i. List 5 examples of bases from the diagram.

- _____
- c. What is the pH of coffee? _____
10. Describe strong acids. _____
11. Describe weak acids. _____
12. Describe strong bases. _____
13. Describe weak bases. _____

You may stop watching at 8:47, but feel free to continue watching if you are interested, or if you would like to learn about pOH.

14. Look at the chart at <http://www.coffeeresearch.org/science/sourmain.htm>, how many acid types are found in coffee? *count them up _____

Watch the video "Introduction to pH, pOH, and pKw" from KhanAcademy <https://youtu.be/2q4vSKwaBtw>

15. What does the Hydroxide Ion molecule include? _____
16. What does the Hydronium Ion molecule include? _____
17. What is autoionization? _____
18. What is the concentration of H⁺ ions in water? _____
(This is expressed in Molarity "M")
19. What is the concentration of OH⁻ ions in water? _____
(This is expressed in Molarity "M")

You may stop watching at 9:24, but feel free to continue watching if you are interested, or if you would like to learn more about calculating pH.

Watch the video "Acid-Base Introduction" from KhanAcademy <https://youtu.be/vShCnTY1-T0>

20. What is the pH of water at 25 deg C? _____
21. Describe an acid (according to the Arrhenius definition). _____
22. Describe a base (according to the Arrhenius definition). _____
23. Why is HCl acidic? _____
24. Why is LiOH a strong base? _____

You may stop watching at 11:30, but feel free to continue watching if you are interested or if you'd like to learn about the Bronsted-Lowry definition of an Acid.