



# The Design of Coffee: An Engineering Approach

*William Ristenpart*

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*The Design of Coffee* provides a non-mathematical introduction to chemical engineering, as illustrated by the roasting and brewing of coffee. Hands-on coffee experiments demonstrate key engineering principles, including material balances, chemical kinetics, mass transfer, fluid mechanics, conservation of energy, and colloidal phenomena. The experiments lead to an engineering design competition where contestants strive to make the **best tasting coffee** using the **least amount of energy** – a classic engineering optimization problem, but one that is both fun and tasty!

Anybody with access to a sink, electricity, and inexpensive coffee roasting and brewing equipment can do these experiments, either as part of a class or with your friends at home. *The Design of Coffee* will help you understand how to think like an engineer – and how to make excellent coffee!

### **FEATURES:**

- \* Covers all aspects of making coffee, from green beans to the final brew
- \* Does not require calculus or college-level chemistry
- \* Emphasizes the scientific method and introductory data analysis with guided data sheets and lab report questions
- \* Includes 9 full experiments, each with background on key concepts, overview of necessary equipment, and detailed instructions:

- Lab 1 - Reverse Engineering a Drip Coffee Brewer
- Lab 2 - Process Flow Diagram and Mass Balances for Coffee
- Lab 3 - The pH of Coffee and Chemical Reactions
- Lab 4 - Measuring the Energy Used to Make Coffee
- Lab 5 - Mass Transfer and Flux during Brewing
- Lab 6 - Coffee as a Colloidal Fluid and the Effect of Filtration
- Lab 7 - First Design Trials: Optimizing Strength & Extraction
- Lab 8 - Second Design Trials: Scaling Up to 1 Liter of Coffee
- Lab 9 - Design Competition and Blind Taste Panel

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