Lesson Plan: From Bean to Brew - The Science and Art of a Perfect Cup

Materials Needed:

- Whole coffee beans (at least one type, two if you want to compare)
- Coffee grinder (burr grinder is preferred, but blade is fine)
- At least two different coffee brewing devices (e.g., French press, pour-over dripper with filters, AeroPress, drip coffee machine)
- Kettle (gooseneck kettle is ideal for pour-overs but not required)
- Digital kitchen scale
- Timer (a smartphone works perfectly)
- Mugs for tasting
- Water
- Pen and notebook or a worksheet for recording observations
- Optional: Milk, sugar, or other additions for the final tasting
- Optional: Blindfold for the introduction activity

Lesson Details

Subject: Applied Science / Culinary Arts

Topic: The Process of Coffee Brewing

Grade Level: 9th Grade (Age 14)

Time Allotment: 90 minutes

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1. Learning Objectives

By the end of this lesson, the student will be able to:

- **Explain** the four key variables that affect coffee extraction: grind size, water temperature, brew time, and coffee-to-water ratio.
- **Demonstrate** the proper use of at least two different coffee brewing methods.
- **Analyze and describe** the differences in taste, aroma, and body between coffees brewed using different variables.
- **Create and justify** a personal "signature" coffee recipe based on their experimental findings.

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2. Instructional Activities & Procedure

Part 1: The Hook - Sensory Exploration (10 minutes)

The goal here is to engage the senses and spark curiosity.

1. **Mystery Scents:** If using a blindfold, have the student wear it. Present them with the scent of whole coffee beans and then freshly ground coffee.
2. **Discussion:** Ask probing questions:

    - "What differences do you notice between the two smells?"
    - "Why do you think they smell different?"
    - "What does the smell make you think of?"
3. **Introduce the Goal:** Explain that today's lesson isn't just about making coffee, it's about becoming a coffee scientist and artist. The goal is to understand *why* coffee tastes the way it does and to control the process to create the perfect cup.

Part 2: The Science - The Four Key Variables (15 minutes)

This is a brief, interactive discussion, not a lecture. Use the coffee and equipment as visual aids.

1. **Introduce the Concept of Extraction:** "Making coffee is all about extraction—pulling the flavor out of the ground beans with water. If we extract too little, the coffee is sour and weak (under-extracted). If we extract too much, it's bitter and harsh (over-extracted). Our job is to find the sweet spot."
2. **Guided Discovery of Variables:**
    - **Coffee-to-Water Ratio:** "What do you think would happen if we used a lot of coffee but only a little water? What about the opposite?" (Introduce the standard starting ratio: 1:16, or 1 gram of coffee for every 16 grams of water).
    - **Grind Size:** Show a few whole beans. Grind some coarsely and some finely. "Which of these do you think water will flow through faster? Which one has more surface area for the water to touch? How might that affect flavor?" (Finer = more extraction, Coarser = less extraction).
    - **Water Temperature:** "We use hot water, but how hot? What if we used boiling water versus just warm water?" (Introduce the ideal range: 195-205°F or 90-96°C, just off the boil).
    - **Brew Time:** "This is how long the water and coffee are in contact. How do you think a 1-minute brew would taste compared to a 5-minute brew?" (Longer time = more extraction).

Part 3: The Experiment - The Brew-Off (35 minutes)

This is the hands-on core of the lesson. The student will brew two cups of coffee side-by-side, changing only one thing, to directly compare the results.

Experiment Option A: Method vs. Method

1. Use the **same** coffee, **same** grind size, and **same** coffee-to-water ratio.
2. Brew one batch with the French press and one with the pour-over.
3. While brewing, the student should take notes on the process for each.

Experiment Option B: Grind vs. Grind

1. Use the **same** brewing method (e.g., Pour-Over) and **same** coffee-to-water ratio.
2. Brew one batch with a **coarse grind** and one with a **fine grind**. Adjust brew time accordingly (a finer grind needs a shorter time).
3. The student should record their exact grind setting and time for each.

Part 4: The Tasting and Analysis (15 minutes)

Set up a "cupping" or tasting session with the two brewed coffees.

1. **Smell First:** Before tasting, smell each cup. Note the differences in aroma.
2. **Taste and Describe:** Take a sip of each. Encourage the student to use descriptive words. A simple tasting chart can help:
    - **Aroma:** What does it smell like? (Nutty, fruity, chocolatey?)

    - **Acidity/Brightness:** Is it bright and tangy or smooth and mellow?
    - **Body/Mouthfeel:** Does it feel thin like tea or heavy like cream?
    - **Flavor Notes:** What specific tastes do you notice?
    - **Finish:** What is the aftertaste like? Lingering? Clean? Bitter?
3. **Discuss Findings:** "Which one did you prefer? Why? How did changing the [brew method/grind size] affect the final taste?"

Part 5: The Creative Challenge - Your Signature Brew (15 minutes)

This is the summative, creative part of the lesson.

1. **The Challenge:** "Based on everything you've learned and tasted, your final challenge is to design your *own* perfect cup of coffee. You can use any combination of the tools and variables we've discussed."
2. **Create a Recipe Card:** The student will brew their signature cup. As they do, they must create a "Recipe Card" that documents their choices:
    - **Recipe Name:** (e.g., "The Morning Motivator")
    - **Coffee Beans Used:**
    - **Brew Method:**
    - **Coffee Weight:** (in grams)
    - **Water Weight:** (in grams)
    - **Grind Size:** (e.g., "Medium-fine, like table salt")
    - **Water Temperature:**
    - **Total Brew Time:**
    - **Creator's Notes:** A short paragraph explaining *why* they made these choices and what flavor profile they were trying to achieve.

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3. Assessment

- **Formative (During the lesson):**
    - Listening to the student's answers and reasoning during the "Four Variables" discussion.
    - Observing the student's ability to follow steps and measure accurately during the "Brew-Off."
    - Evaluating the descriptive language used during the tasting and analysis.
- **Summative (End of lesson):**
    - The completed **Signature Brew Recipe Card** will serve as the final assessment. It will be evaluated on its completeness, clarity, and the quality of the "Creator's Notes," which should demonstrate an understanding of how the variables connect to the final taste.

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4. Differentiation and Extension

- **For Support:**
    - Pre-measure the coffee and water to focus only on the brewing technique.
    - Use a simple automatic drip machine as one of the methods to reduce complexity.
    - Provide a "word bank" of tasting notes (e.g., acidic, bitter, smooth, bold, earthy, floral) to help with description.
- **For Extension / Deeper Dive:**
    - **Research Project:** Research the origin of the coffee beans being used. How does the country of origin and processing method (washed, natural) affect the flavor profile?
    - **Latte Art:** If you have an espresso machine or milk frother, extend the lesson into milk steaming and the basics of pouring latte art.
    - **Blind Taste Test:** The student prepares three cups of coffee (e.g., one under-extracted,

one over-extracted, one "just right") and has a family member taste them blind to see if they can identify the best cup.