

Introduction

Building models to explain natural phenomena is a core activity of science. Models can be made to explain things that can be *seen*. Sometimes, though, models are made to explain what is *unseen*.

The goal of this exercise¹ is for students to investigate the unseen and create a correct model using CEW (Claim, Evidence, Warrant). Students may work singly, in pairs, or in groups. Depending on which form of grouping you choose, you will need to adjust the amount of supplies accordingly.

Objective

To accurately predict the contents of a sealed black film canister by building and testing models.

Materials

1. *Black* film canisters—two per student/pair/group
2. Small, loose items of various materials (ferrous metal, nonferrous metal, plastic, etc.) that fit in the film canisters, such as:
 - Corks
 - Cotton balls
 - Macaroni
 - Marbles
 - Nails
 - Paper clips
 - Pennies
 - Popcorn kernels
 - Q-tips
 - Staples
 - Thumbtacks
 - Uncooked rice
3. Electrical tape
4. Labels for canisters (numbers or letters on each cap)

¹This activity is adapted with permission from *REAL Science Challenge*, www.realsciencechallenge.com.

Preparation

1. Collect approximately 20 different items and duplicates. There should be enough of each item to include some in the canisters with reserves available for student testing. The number of duplicate items will vary based on the number of testers. However, collecting each item in the amount of half the number of testers is a good formula.
2. Store items in a compartmented case, if possible, as this allows students a view of all available items and easy access to extra items.
3. Before class, fill the black film canisters with a combination of three different items. Fill enough canisters for each individual, pair, or group to have one canister.
4. Place a number or letter label on the cap of each canister.
5. Note the contents of each canister on the Canister Content Key.
6. Seal each canister around the edge of the cap with electrical tape.

Canister Content Key

Canister	Item 1	Item 2	Item 3
Example: A	Small paper clip	1/2-inch brad nail	Yellow plastic wire nut

Running the activity

Give each student the **Film Canister Experience Handout**, which contains instructions for the activity. See the handout for detailed instructions for running the activity.

Notes from Pilot Teachers

1. A selection of 20 different items were used, with 3 different items per container. No canister had two of the same item; no two canisters had the same three items.
2. It is okay if one of the objects can't move around in the canister, but it does make it more challenging for students to determine the contents.
3. Remind students that their experimental canister is the model they are building to represent their sealed canister. Their goal is to create a model that behaves so much like the sealed canister that it accurately predicts its contents. They will get frustrated, so be ready to guide them with questions.
4. Students tend to get stuck in a testing rut. For instance, they may only rely on sound and may spend too much time simply shaking the canister. Be prepared to ask questions that get them to think of other testing methods or ways to enhance their senses like:
 - Movement
 - Magnetism
 - Mass
 - Use of a stethoscope
5. If time allows, or if student interest dictates, you can have students trade canisters and conduct additional tests or verify results.
6. Variation: Give all students sealed canisters with the same three items. The inevitable differing results could lead to great discussions about experiment design, effective observations, and quality conclusions.

Experience Debrief

- How was this experiment different than the labs you have traditionally done in your science classes?
- What were the greatest challenges you faced?
- What virtues were tested?
- What did you learn about the process of creating scientific models?
- What would you do differently?