Mystery Boxes  Leader's Activity Guide

This activity will put students in the shoes of a scientist. This can be a frustrating experience for students who must be given the "right" answer. Often students have a poor conception about the test of the truth of knowledge. This activity attempts to give them a sense that correct hypotheses are those supported by data.

What you will need
(per student or pair of students)

★ 1 mystery box for each student or for each pair of students.

Organizing this activity

Encourage the students to do as much indirect data gathering as possible. They usually tend to want to quit quickly and just pull the box apart and look inside. Reinforce the idea that this is a model and that in the real world scientists can't just "pull off the top" of an atom to look inside. The frustration the students feel is good in that it is similar to the feeling real researchers often have in pursuing a problem.

The students are using the scientific method to determine what is in their mystery box. The classic steps of the scientific method are

1. Define the problem
2. Make observations
3. Form a hypothesis
4. Design an experiment to test the hypothesis
5. Evaluate the experiment and accept or reject the hypothesis

They should use size, mass, and shape in their observations.

It may help to have a table in the front of the room with duplicates of some or all of the objects that are inside the mystery boxes. This makes the choices easier, especially for younger children. Then students only have to select which of the many objects they have inside their mystery box.

As a final activity, divide the chalkboard into as many sections as you have boxes and ask students to write
their hypotheses about the contents of the boxes they tested. When all the guesses are on the board, look for agreement in answers and lead a discussion on which answers are acceptable. Allow students time to tell what criteria led them to each hypothesis. Also you should develop the criteria for an acceptable answer.

This is a great time to explain how scientists know they are “right.” If the evidence agrees with the hypothesis, then an answer is generally considered correct. But remind them that sometimes new evidence may cause a scientist to reevaluate a hypothesis previously considered correct. If something does not agree, then the hypothesis must be changed. The extent to which the answers agree on the board dictates the right answer in this case. You may or may not want to actually open the boxes. There is some argument for either approach.

How to make a mystery box

A mystery box is nothing more than a common classroom object that has been sealed in a container.

You will need some kind of container for the mystery box. Choose something available to you in quantity because you need 15–30 boxes. There is some advantage to having uniform containers. Consider cottage cheese or yogurt containers, small boxes, shoe boxes, oatmeal boxes, or similar containers. The postal service or courier-type offices often have boxes. Variety stores may have small gift boxes. Visit a local fast food restaurant and see if a burger box is available in the quantity you need.

What should go in the mystery box?

Here are some suggestions, but do not feel you need to limit yourself to these:

- paper clips, scissors, pencil, pen, roll of tape, glue bottle, calculator, small ball, paintbrush, Pink Pearl-type eraser, single hole punch, rubber stamp, pad of Post-it notes, crumpled wad of notebook paper, lip balm or lipstick, eyeglasses, finger ring, apple, banana, row of staples, test tube, screw top from jug or bottle, buttons (campaign-type or coat buttons), protractor, or compass.

It is acceptable to have the same item in more than one box if you can obtain only a limited number of mystery objects.

Tape or glue the boxes shut and number them with masking tape and a permanent marker. There is considerable pressure for the student to try to peek inside the boxes, so the more secure they are, the less hassle for you. This is all quite a bit of work, but you can use the boxes over and over again.
Mystery Boxes

Using the scientific method to solve problems

How do scientists learn about things when they are too small to be seen or too far away to be seen? For example, how do we know what is inside an atom or distant stars? The answer is easy. Just because you can't see something does not mean you can't gather information. Just as you can learn something about a bicycle by looking at its shadow, you can learn about an atom by indirect clues.

What you will need (per student or group)

* mystery box

Before you begin

You are being given a "mystery box" by the leader. It has a common classroom object inside it. You must try to identify the contents of your box without looking inside it! Sound impossible? By learning all you can from the outside, you will be surprised by how much you can learn about what is inside the mystery box.

The process you will use is called the scientific method. The steps of the scientific method are

1. Define the problem
2. Make observations
3. Form a hypothesis
4. Design an experiment to test the hypothesis
5. Evaluate the experiment and accept or reject the hypothesis
**What you get to do!**

How do scientists know if they are right? They design a test, called an experiment. Let’s say you believe there is a pencil in your box. Think of what the pencil would do if you moved the box in a certain way. For example, if you tilted the box down, the pencil would roll with a certain sound.

**Step 1** Make a lab record including the steps of the scientific method. Obtain a mystery box from the leader and make as many observations as possible on your data sheet. You may shake, roll, rattle, smell, or tilt the box. You may do anything *except* open the box.

**Step 2** Make a prediction. Be as specific as possible, and include the size, mass, shape, and identity of the mystery object. When you have an idea about what the object is, write it in your lab notebook and go on to another box.

**Step 3** When you are finished check with the leader about your predictions (your hypothesis). If you reject your hypothesis, design a new test (observation), and make a new prediction (form a hypothesis).

**Clean Up!**

Return the boxes to the leader when you are done.
What is going on here?

When you have finished several boxes, the leader will help you to compare your guesses or hypotheses with those of others. Go to the board and write down what you thought was inside the boxes and see how your hypotheses compare with those of others.

The class will vote and decide which answers to believe and which ones to discard.