

Classifying Matter

A “Nuts-and-Bolts” Demonstration



Introduction

Bulk samples of an element, a compound, and a mixture may look similar “on the outside.” But when we talk about these concepts with students, we are asking them to see what they look like “on the inside”—we want them to imagine atoms and molecules and mixtures of these and notice how they are different. This “nuts and bolts” demonstration will help your students visualize abstract concepts relating to the classification of matter.

Concepts

- Element
- Compound
- Mixture
- Classification of matter

Materials

- | | |
|--------------------------------|--------------------------|
| Bolts or machine screws, small | Overhead projector |
| Hex nuts and washers to fit | Petri dishes, plastic, 9 |

Safety Precautions

Although the materials in this demonstration are considered nonhazardous, follow all laboratory safety guidelines.

Preparation

Label a set of Petri dishes A–I and place the following objects in each.

- Six bolts
- Six nuts
- Six washers
- Three bolts and three nuts (not assembled)
- Two bolts, two nuts, and two washers (not assembled)
- Three “nut and bolt” assemblies
- Two “nut-bolt-washer” assemblies
- Two “nut and bolt” assemblies and two extra bolts or nuts
- Two “nut and bolt” assemblies and two “nut-bolt-washer” assemblies

Procedure

- Have students prepare a data sheet and label it “Element, Compound or Mixture” at the top and “A–I” down the side.
- Select one of the Petri dishes at random and place it on the overhead projector.
- Tell the students to imagine that *each object* represents either an atom or a molecule, then ask them to *silently* identify whether the *collection of objects* in the Petri dish represents an element, a compound, or a mixture. Have the students write down their choice on their data sheet.
- Repeat steps 2 and 3 with the other Petri dishes. To make students think and keep them guessing, randomly select the Petri dishes from the available set.
- After all of the Petri dishes have been shown, discuss the findings with the class.

Disposal

None required. Seal the Petri dishes with tape and reuse them every year.

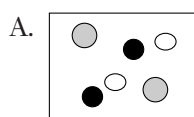
Tips

- An alternative way to conduct this demonstration is to place the dishes on lab benches around the room and have students circulate around the room to examine the samples and complete a data sheet.
- Other questions to ask the students include: Are the contents homogeneous or heterogeneous? Name a real example corresponding to the type of substance in each Petri dish.

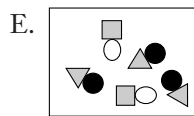
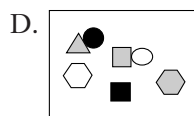
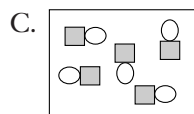
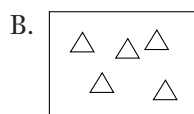
Discussion

Do not focus on “right and wrong” answers during the classroom discussion. Encourage students to share their reasoning with the class so they can discover the abstract concepts on their own. Petri dishes A, B, and C represent elements, while Petri dishes D and E contain mixtures of elements. Petri dishes F and G represent compounds. Petri dish H contains a mixture of compounds and elements, while I contains a mixture of compounds.

Use the following figures and questions as a follow-up assessment after the demonstration.



Match the boxes at the left with the descriptions given below:



- _____ 1. element
 _____ 2. compound
 _____ 3. mixture of elements
 _____ 4. mixture of compounds
 _____ 5. mixture of compounds & elements

Which of the boxes at the left (there may be more than one correct box) contain:

- _____ 6. only atoms, no molecules
 _____ 7. only molecules, no separate atoms
 _____ 8. both atoms and molecules

NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

Disciplinary Core Ideas: Middle School

MS-PS1 Matter and Its Interactions

PS1.A: Structure and Properties of Matter

Disciplinary Core Ideas: High School

HS-PS1 Matter and Its Interactions

PS1.A: Structure and Properties of Matter

Science and Engineering Practices

Asking questions and defining problems

Constructing explanations and designing solutions

Developing and using models

Crosscutting Concepts

Patterns

Scale, proportion, and quantity

Reference

This activity was adapted from *Flinn ChemTopic™ Labs*, Vol. 1, *Introduction to Chemistry*; Cesa, I., Editor; Flinn Scientific: Batavia, IL (2002).

Classifying Matter—A “Nuts-and-Bolts” Demonstration is available as a chemical demonstration kit from Flinn Scientific, Inc.

Catalog No.	Description
AP6291	Classifying Matter—A “Nuts-and-Bolts” Demonstration
AP6253	Flinn ChemTopic™ Labs, Vol. 1 Introduction to Chemistry

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.