



# Interactive Session: Science

How well do science activities align  
with content standards?



# Learning Goal on Conservation of Matter

No matter how substances within a closed system interact with one another, or how they combine or break apart, the total mass of the system remains the same. The idea of atoms explains the conservation of matter: If the number of atoms stays the same no matter how they are rearranged, then their total mass stays the same. *Benchmarks, 4D 6-8, #7*



# Clarifying the Learning Goal

- *Science for All Americans.*
- *Benchmarks* essays.
- *Benchmarks*, the Research Base Chapter of.
- *Atlas of Science Literacy.*



# Conservation of Matter Learning Goal

## Ideas included:

- Atoms can combine and recombine.
- Atoms do not disappear or appear from nothing.
- A closed system or container, does not allow substances/atoms to leave or new substances/atoms to enter.

## Ideas that go beyond:

- The distinction between atoms and molecules.
- Calculations of grams, molar mass, and mole ratios of reactants and products.
- Details of the structure of the atom.



# Content Alignment Questions

- Does the activity address the key idea(s) of the learning goal or is there only a topical match?
- Does the activity reflect the level of sophistication of the learning goals or does the activity target a learning goal at an earlier or later grade level?
- Does the activity address the entire learning goal or only a part of the learning goal?



## Sample Activity: Is It Aligned?

- From a balanced chemical equation, students are asked to determine the mass of starting material needed to produce a given mass of product. First they convert the given mass of product to moles. From the mole ratios of the balanced equation, they find the number of moles of the starting material that are equivalent to the number of moles of product. Then they convert moles of starting material to mass.



## Sample Activity: Is It Aligned?

- Students add a teaspoon of sugar to a cup of water, after having weighed both the sugar and the water. They predict what the solution will weigh, weigh it, and attempt to explain their findings.



## Sample Activity: Is It Aligned?

- Students read about Lavoisier's investigation of burning magnesium and make models out of gum drops and toothpicks to account for his findings. When Lavoisier heated a strip of magnesium metal it burned, leaving a white powder that was heavier than the initial mass of magnesium. However, when he performed the same investigation in a closed flask, he observed no change in mass.



# Sample Activity: Is It Aligned?

- Students use ball-and-stick molecular models to represent the equation for photosynthesis.



## Sample Activity: Is It Aligned?

- Students identify several items they use daily and then a) analyze the resources involved in their use or manufacture, b) identify waste materials involved in using each item, and c) classify resources involved as “renewable” or “nonrenewable.”



# Common Difficulties for Students' Understanding Conservation of Matter

- Confusion between weight and density:
  - Solids are thought to weigh more than liquids.
- Reaction gases may cause difficulties:
  - Students do not think that gases contribute to the mass of products or reactants.
  - Students may assume that any gas is air.
  - Students may believe that when things burn up, they disappear.