

RAFT IDEAS

Topics: Phases of Matter,
Atoms and Molecules,
Matter and Chemistry

Materials List

- ✓ 3 CD jewel cases
- ✓ Pony beads, mini or regular – use beads that will be able to move around in the CD jewel cases
- ✓ Tape or glue

This activity can be used to teach:

- Property of materials (Next Generation Science Standards: Grade 2, Physical Science 1-1)
- Structure of matter (Next Generation Science Standards: Grade 5, Physical Science 1-1)
- Changes of state (Next Generation Science Standards: Middle School, Physical Science 1-4)



Just a Phase

Modeling the Phases of Matter (Solids, Liquids, and Gases)



Matter exists naturally on Earth in 3 phases: solid, liquid, and gas. These models help students visualize what is happening on the atomic or molecular level in each phase.

Assembly

1. For the gas model, place about 20 beads into an empty jewel case and seal shut.
2. For the liquid model, fill a jewel case about $\frac{1}{2}$ full with beads and seal shut.
3. For the solid model, fill a jewel case completely full with beads and seal shut. Make sure that the beads are tightly packed so that they can only “vibrate” when shaken.

To Do and Notice

1. Move and shake the jewel cases, observing the motion of the beads in each case and comparing the phase models. In each case, the beads in the model represent small pieces of matter, either atoms or molecules.
2. Notice that the beads in the case representing a “solid” are unable to move around freely, but only vibrate in their “crystalline” structure. The atoms in solids are locked into a specific structure, determined by their atomic make-up (i.e.- sodium chloride (table salt) crystals (NaCl) are always cubic; quartz crystals (SiO₂) are always hexagonal.)
3. The beads in the case representing a “liquid” are free to flow around one another. They take the shape of the container and are not locked into a specific crystalline structure.
4. The case representing the “gas” has only a few beads; there are not as many particles per given space in a gas. The atoms or molecules in a gas move around freely and quickly, rarely running into one another. If energy (heat) is added to the gas (by shaking the case harder), the particles move around more quickly, hitting the sides with greater frequency.
5. Optional: Divide students into groups and have the students in each group represent atoms in one of the phases of matter. Good to do outdoors.

The Science Behind the Activity

Matter on Earth exists in 3 phases: solid, liquid, and gas. Of these three phases, gases have the most energy and solids have the least. (Note: the fourth, most energetic phase of energy, plasma, is presented in high school physics or chemistry.) Every substance exists in a particular phase at a given temperature and pressure. Each substance changes phase as conditions change. For example, in order to melt solid water (ice), add heat; if more heat is added, the liquid water turns to gas. Unknown materials can be identified or separated by determining their boiling or freezing points. For example, crude oil is separated into component substances (alkanes) via a “cracking tower” which raises the temperature of the oil and collects each substance as it boils off.

Web Resources (Visit www.raft.net/raft-idea?isid=177 for more resources!)

For a chart showing the energy (heat) required to change the phases of water, go to: <http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/phase.html>