RAFT IDEAS

Topics: Chemistry, Physical and Chemical Change, History

Materials List

- ✓ Melt-and-Pour glycerin soap
- ✓ Portion cups or other molds
- ✓ Measuring cup or other microwave safe container
- ✓ Knife
- ✓ Microwave oven
- ✓ Craft stick or spoon
- ✓ Items to place in soap (optional)
- ✓ Rubbing alcohol (optional)

This activity can be used to teach:

- Phase Changes and Properties (CA Science Standards: Grade 1, 1.a and 1.b; Grade 3, 1.e and 1.f; Grade 5, 1.g; Grade 8, 3.c, 3.d and 3.e)
- Physical and Chemical Properties of Matter (CA Science Standards: Grade 5, 1.f)

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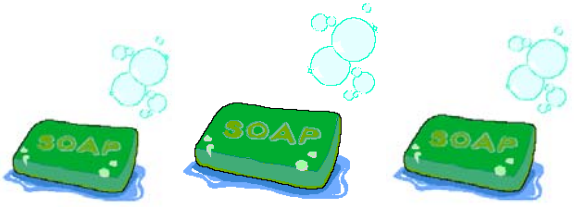
Keeping it Clean is Neat!

The Academics of Soap



Soap is such an everyday part of our lives that we tend to take it for granted. Most students do not know that the basic ingredients needed to make soap are fat (such as lard) and lye (the active ingredient in many drain cleaners). Because students are so familiar with it, teachers can use melt-and-pour soap as a springboard to help students learn about many academic concepts, such as physical properties and phase changes.

To Do and Notice (Use this activity as a demonstration with younger students. Hot soap from microwave can cause burns!)

1. Cut melt-and-pour soap into about 2.5 cm (1") chunks and place into a microwave safe container.
2. Melt in a microwave oven for 30 seconds; stir; repeat until melted.
3. Pour into molds. Remove when cool (after about 30 minutes).
4. Melt soap before adding items such as glitter, herbs, or small toys.
5. Layering colored soaps can create special effects. To achieve a layered effect, pour the first color into the mold and let cool, then spritz the surface with rubbing alcohol before adding the next layer using a different color.

During the process, encourage students to make observations about the changes that soap goes through in the melting/cooling process. The solid soap melts when heat is added, becomes a liquid; and then solidifies when cooled.

The Content Behind the Activity

Images from:
http://www.sdahq.org/cleaning/history/

History

Soap got its name, according to an ancient Roman legend, from Mount Sapo (in Italy), where animals were sacrificed. Rain washed a mixture of melted animal fats and wood ashes (containing lye) down into the clay soil along the Tiber River. Women found that this clay mixture made their wash cleaner with much less effort.

Today, soap is still made from a variety of rendered animal fats and plant oils, including tallow (bovine fat), lard (porcine fat), olive oil and coconut oil. The craft of making soap from scratch has increased in popularity in recent years as a hobby.

Developed and written by Coral Clark (RAFT)

Chemistry
Melt-and-Pour soaps used in this activity are undergoing physical changes rather than chemical changes. As they melt and then solidify, the soaps exhibit phase changes (solid to liquid back to solid); however, the chemicals involved remain the same. In terms of the 3 phases of matter, solids have the least amount of energy, liquids have more energy, and gases have the most. In order to change the solid soap to a liquid (melt), heat energy must be added. When the liquid soap loses the heat energy upon cooling, it returns to its solid state.

The chemistry involved in making soaps from raw ingredients is more complicated: the molecules in the ingredients (reactants) are changed in the process to new molecules with new properties. Soaps are made when **fats and/or oils** and **lye** (a caustic substance!) undergo a chemical change called saponification:

$$[C15H31CO]3[C3H5O3](s) + 3\ NaOH(aq) \text{ -----> } 3\ C15H31COONa(aq) + C3H5(OH)3(aq)$$
fat(s) + 3 lye(aq) -----> 3 sodium palmitate(aq) + glycerol(aq)

Soaps work by reducing the surface tension of water, helping it to clean better. Soap molecules are also polar: one end of soap molecules are attracted to oils, helping remove them from surfaces.

Glycerin soaps (clear) are made by dissolving soap into glycerin using water and alcohol.

Taking it Further
Consider using this RAFT soap in the following ways:

- Students can compare different types of soap [clear (glycerin) soap, opaque (coconut oil) soap, and store bought soap such as Ivory] to get practice observing physical properties such as translucency, ability to melt, hardness, solubility, amount of lather produced, and density (does it float?)

- Soap is an example of an amorphous solid, meaning that it is a solid that does not have a crystalline structure. Other examples of amorphous solids are silly putty and glass. Students can compare a variety of amorphous solids and discover common traits, such as they tend to be malleable.

- Have students carve objects out of the soap for an art project. Compare the hardness of soap to that of marble to help student gain perspective on the difficulty of classic sculpture.

- Students can do experiments on light by using the clear soap as a lens, Cut the soap into lens shapes and have students make observations of the path that light takes traveling through the soap. Students can modify the lenses and observe how this changes the light path.

- Dissolve the different soaps in water. Compare the soap solutions in their ability to make good bubbles. Which type works the best?

Web Resources (Visit www.raft.net/more for how-to videos and more ideas!)
An Excellent source of information on the history and chemistry of soap is available at:
http://www.sdahq.org/cleaning/soaps_and_detergents.html

Browse the book ***Caveman Chemistry*** by going to: http://cavemanchemistry.com The book contains interesting historical facts and stories about chemistry, from fire to soap to plastics; the link also contains book purchasing information.

Teacher Note: **There are many recipes for making soap from scratch on the web. This level of activity should only be used with higher level students because of the caustic nature of lye.**