Milk Trick Lesson Plan

Amount of time Demo takes: 1-3 mins.
Try this at home!

Materials
- Petri dishes or small, shallow dish (2)
- Half and Half (1 gallon/day)
- Food coloring (1 box/day)
- Liquid dish soap (Palmolive works very well) (1 bottle)
- Droppers (2)
- Beaker for Half and Half
- Bucket for waste
- Clorox wipes for clean up

Set-up Instructions/Instructional Procedure
1. Pour 10 mL of Half and Half into a petri dish.
2. Carefully drop two drops of food coloring near the edge of the petri dish.
   a. The food coloring is just for display purposes.
3. Quickly and carefully drop two drops of dish soap in the middle of the petri dish; observe!
4. Take a few moments to watch the process and have students tell you what they observe. See if they have any ideas as to why this happens.
5. Optional: Change a variable and redo the demo - make sure the scientific process is followed.

SAFETY! Safe Demo

Lesson’s Big Idea
- The Half and Half contains fat molecules and water molecules, among others. Soap has both polar (ionic/having a charge) and non-polar structures in it. The polar end is a salt - think of it as the ‘head’ of the molecule, and the long chain of non-polar hydrocarbons is the ‘tail.’
- When the dish soap is dropped into the Half and Half, the molecules dive in ‘head first.’ This is because the salt end of the soap molecule is hydrophilic and the water in the Half and Half is polar, so the two are attracted to one
another. The hydrocarbon tail is hydrophobic (“afraid of water,” attracted to the oils and greases in the milk.) Thus, the head of the soap molecule goes into the Half and Half, while the tail of the molecule stays above the surface to avoid the water:

![Monolayer of Soap on Water](http://www.elmhurst.edu/~chm/vchembook/images/554monolayer.gif)

- The fatty molecules in the Half and Half move away from the soap. The soap disrupts the surface tension of the milk by working its way in between the Half and Half molecules (breaking the bonds along the surface.) The fat molecules in the interior become surrounded by soap molecules, whose tails face in toward the fats this time; basically, this is the ‘flipped’ version of what happens on the surface:

![Soap molecules](http://www.newciv.org/pic/nl/artpic/434/3/soap.gif)

- From Klehle and Klinke: Surface tension also plays a role in the movement of molecules. Surface molecules are pulled strongly to the sides and down, but do not feel a strong attraction to the few gas molecules above the liquid. Interior molecules feel equal attraction to neighboring molecules in all directions. The result is a pretty display of color that is moved below the milk and back to the center.

**Assessment/sample questions you can ask**

- What will happen when food coloring and liquid dish soap are carefully
dropped into a container of Half and Half?

**Clean Up**
- Clean up spills to not have sour milk smell by end.
- Clean up between demos if needed. When completely finished gather all materials listed for this demo and make sure everything is accounted for. If something was used up, broken, or damaged, let someone know so it can get replaced or fixed.

**References**
- Lesson written by C. Klehle and K. Klinke 1997
  [http://www.jms.gjcs.k12.in.us/Science%20Sleuth%20Mysteries/teacher%20resources/lessonplan1.html](http://www.jms.gjcs.k12.in.us/Science%20Sleuth%20Mysteries/teacher%20resources/lessonplan1.html)
  [http://www.elmhurst.edu/~chm/vchembook/554soap.html](http://www.elmhurst.edu/~chm/vchembook/554soap.html)
- How does soap clean? by Silvia Martinez (2005)

**Next Generation Science Standards**
- **K-5**
  - 3-PS2-1
  - 5-PS1-1
- **6-8**
  - MS-PS1-1/2
- **9-12**
  - HS-PS1-3