Chapter 7: Quick Activities

How Molecules Mix

Circular Rainbows

We can separate the components of ink through a technique called *paper chromatography*. All you need are some felt-tip pens or water-soluble markers; some porous paper, such as a paper towel, table napkin, or coffee filter; and some water.

PROCEDURE

1. Place a concentrated dot of ink at the center of the piece of porous paper.

2. Dip your finger in some water so that a drop of water hangs from the tip of your finger. Touch this drop of water to the dot of ink and watch the water get absorbed by the paper. The moment it is all absorbed, add another drop. Continue adding drops in this fashion, allowing the water to spread radially through the paper.

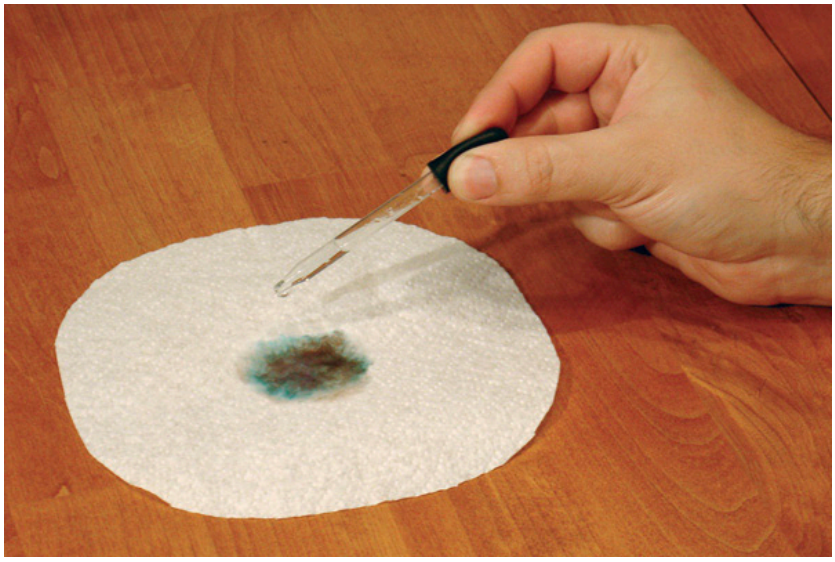
3. The different color components of the ink will separate while the water travels through the paper. Experiment using different inks and paper. Try other solvents, such as rubbing alcohol, fingernail-polish remover, or white vinegar.

ANALYZE AND CONCLUDE

1. The different components of the ink have differing affinities for the paper and the mobile solvent. Which components have a greater affinity for the paper? Which have a greater affinity for the water?

2. Why doesn't the ink from a permanent marker work for this activity?

3. How do you suppose a chemist separates the different products she's created through a chemical reaction?



Water Balloon

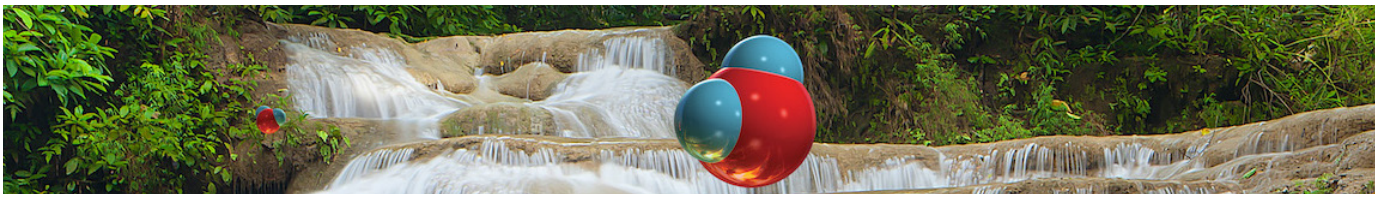
To see the action of the ion–dipole attraction, create a static charge on a rubber balloon by rubbing it across your hair. Hold this charged balloon close to but not touching a thin stream of water running from a faucet. Watch the charged balloon divert the path of the falling water. Your balloon is negatively charged because it picks up electrons from your hair. Why would a balloon that was positively charged also attract the stream of water?

Rock Candy

Here's a quick recipe for rock candy. In a cooking pot, make a hot, saturated solution of sugar in water. Start by mixing sugar and water in a 2:1 ratio by volume. Add more sugar or water as necessary to obtain a clear, runny syrup. Let cool for 10 minutes. Roll a wet skewer stick or weight (such as metal nut) attached to a string in some granulated sugar. Pour the warm sugar syrup into a jar. Submerge the skewer or weight in the sugar syrup. Cover the top and store the sugar syrup in a cool place. The longer you wait, the larger the crystals.

Filled to the Brim

Just because a solid dissolves in a liquid doesn't mean the solid no longer occupies space. Fill a glass to its brim with the warm water and then carefully pour all the water into the larger container. Add a couple tablespoons of sugar to the empty glass. Return half of the warm water to the glass and stir to dissolve all the sugar. Return the remaining water, and as the water gets close to the top of the glass, ask a friend to predict whether the water level will be less than, about the same as, or more than before. If your friend doesn't understand the result, ask him or her what would happen if you had added the sugar to the glass when the glass was full of water.



Author Responses to Quick Activities

Circular Rainbow

1. The components that travel slower have a stronger affinity for the paper, while those that travel faster have a stronger affinity for the water.
2. The permanent ink has practically zero affinity for the water.
3. A chemical reaction will typically result in multiple products. The chromatography technique described here is a primary means by which the chemist is able to isolate individual products.

Water Balloon

The water molecules have both negative and positive ends. Hold a negatively charged balloon up to the water and all the water molecules will rotate to have their positive ends face the balloon. Hold up a positively charged balloon and all the water molecules will rotate to have their negative ends face the balloon. Either way, the balloon always attracts.

Rock Candy

Interesting crystals can also be made from supersaturated solutions of Epsom salts ($MgSO_4 \cdot 7\ H_2O$) and alum ($KAl(SO_4)_2 \cdot 12\ H_2O$), which is used for pickling and is available in the spice section of some grocery stores. Compare the crystal shapes of Epsom salts, alum, and sugar.

Filled to the Brim

The water level rises just as it would if you were adding sand. It does not matter that what you add also dissolves.