Welcome to
The Artsy Parts of Science
workshop at Arts for All Conference
February 21, 2009, Battle Creek Middle School
Jane Snell Copes

So, is this art or is it science? Hmmmm . . .

What do artists do?
find inspiration in nature
use color, texture, symbol, sound, motion
try something and see if it works
try something else
remember what didn't work
make something new
solve problems creatively
never give up
share their results

What do scientists do?
ask questions of nature
use materials with specific properties
try something and see if it works
try something else
remember what didn't work
make something new
solve problems creatively
never give up
share their results

What's up today? We'll have fun investigating
colors from cabbage
taking colors apart
putting colors together
oobleck
play clay
colors in bubbles

Four great color science books
Over the Rainbow by Barbara Taylor, Random House, 1991
The Optics Book by Shar Levine and Leslie Johnstone Sterling, 1998
The Science Book of Color by Neil Ardley, HBJ Gulliver Books, 1991
Light and Color by Gary Gibson, Copper Beech Books, 1995

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Taking Colors Apart
The Artsy Parts of Science

What you need:
- paper towel squares or cone-style coffee filters
- plastic tumbler cups
- small plastic cup for water
- water-soluble markers

What's the big idea:
We use paper chromatography to separate colors in water-soluble marker ink.

What to do:
- Use a marker to make a circle about the size of a dime or quarter in the middle of one sheet of paper. Don't fill in the circle.
- Set the circle on an empty plastic cup.
- Use your finger to add drops of water to the center of the circle. Watch what happens.
- Where did those colors come from??
- Stop when one ring of color has traveled almost to the edge of the paper OR when the water edge passes up all the colors.

What else?
Purple, Green, and Yellow by Robert Munsch is a great adventure with markers!

You can use permanent markers with rubbing alcohol to make great patterns on fabric.

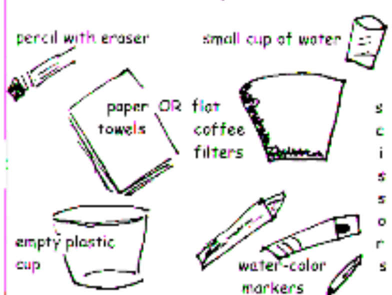
Other kinds of chromatography are used to analyze drug mixtures, gasoline components, foods and many other mixtures.

Why does it work?
Chromatography is a general method of separating mixtures. In this experiment, the mixture is the inks in a water-soluble marker. You can't tell what colors of inks will be mixed in any particular marker until you try the experiment. Even primary colors may have more than one color of ink mixed together.

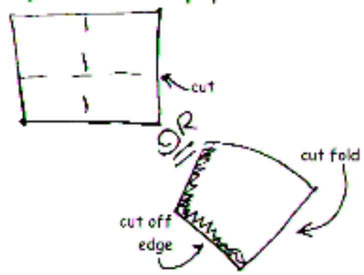
Chromatography relies on a solid or stationary phase (the paper) and a liquid or mobile phase. (water). These two phases are competing to attract the pigments in the inks. Some pigments in inks will stick better to the paper. Other pigments will be more attracted to the water. The colors that are most soluble in water travel the farthest away from the original application of ink.

_________________'s Directions for _Paper Chromatography_ Experiment

step 1 Collect your stuff.



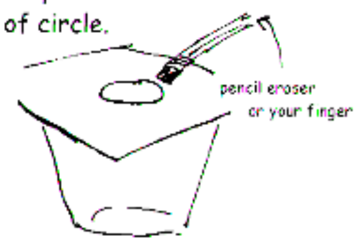
step 2 Cut paper.



step 3 Draw marker circle on paper.

step 4 Put paper on cup.

step 5 Touch water to center of circle.



step 6 Watch what happens! Add more water as ink spreads.

Words I need: paper, absorb, chromatography, dissolve, water-soluble, mixture, separate, chromatogram, chromatographer.

Colors from Cabbage
The Artsy Parts of Science

What you need:
- head of purple cabbage
- blender
- hot tap water
- strainer
- bottle
- plastic cups
- 3 droppers
- small spoons or wood coffee stirrers
- safety glasses
- white plastic ice cube tray or egg carton
- distilled vinegar
- baking soda
- household ammonia
- cream of tartar

What's the big idea: Purple cabbage juice turns beautiful colors when mixed with common food items.

What to do:
- To make cabbage juice, tear up several leaves of purple cabbage into a blender jar. Cover with hot tap water. Buzz until big chunks are gone. Strain into a bottle. Don't try to store cabbage juice for long—it spoils very quickly!
- Put a dropperful of cabbage juice in 5 wells of the ice cube tray. It won't fill the wells.
- Test each food item in a different portion of purple cabbage juice. Record results on the next page.
- Now try the 3 Challenges: make a blue or green well turn pink. Make a pink well turn blue or green. And make one well fizz. Be sure to tell how you met the challenges.
- Drop your whole tray in the clean-up bucket before you move on. Replace lids and spoons on the solids, and neaten up, please.

Why does it work?
Purple cabbage juice, like many deeply colored foods is an acid-base indicator. It turns pink in acids and blue or green in bases. Acids and bases are all related to water, H_2O, which is BOTH acid and base:

$$H_2O = H^+ + OH^-$$

hydrogen ion (the acid part) hydroxide ion (the base part)

These color changes are caused by chemical changes in the structure of the colored compounds in the purple cabbage juice. To make FIZZ, you need baking soda and an acid, plus water if the acid happens to be a solid (like cream of tartar).

What else?
How could you make pink lemonade without food coloring?

Natural and artificial colors can be affected by acids and bases.

pH (the Power of Hydrogen) is a log-scale way to represent acid concentration. pH values below 7 are acidic, above 7 are basic. Totally pure water would have pH 7.

Mystery Chemicals

Wear your safety glasses! Put one dropper-full of purple cabbage juice in 5 wells of your white tray. Add small amounts of a chemical to separate wells. Write down the colors you see.

	baking soda	vinegar	cream of tartar	ammonia
purple cabbage juice				

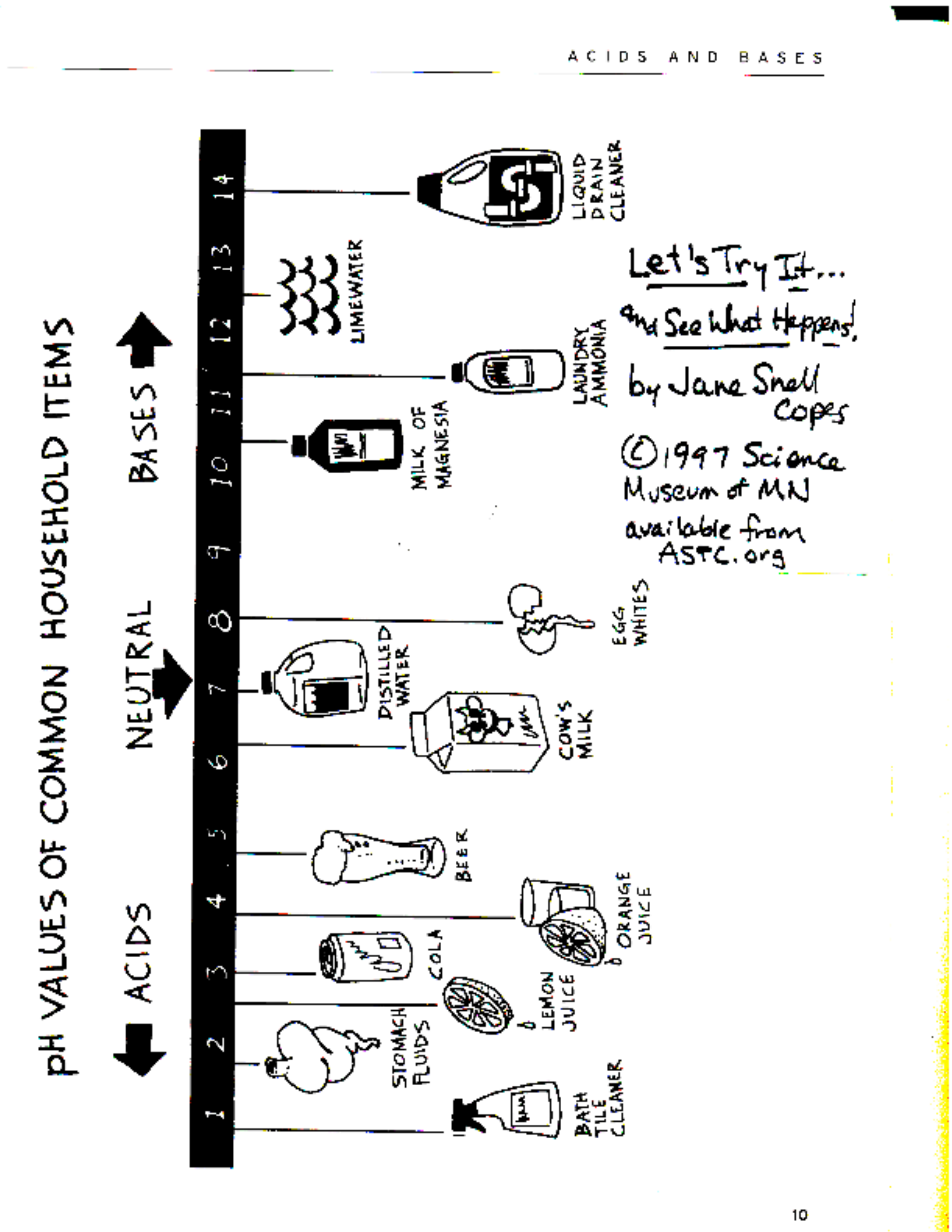
Challenge 1: Make any pink well turn blue or green.

Tell how! ___________________________

Challenge 2: Make any blue or green well turn bright pink. How did you do it?__________________________

Challenge 3: Make one well fizz. What's your secret? "Mix everything together" doesn't count!

____


ACIDS AND BASES
pH VALUES OF COMMON HOUSEHOLD ITEMS
ACIDS
NEUTRAL
BASES
1
2
3
4
5
6
7
8
9
10
11
12
13
14
BATH TILE CLEANER
STOMACH FLUIDS
LEMON JUICE
COLA
ORANGE JUICE
BEER
COW'S MILK
DISTILLED WATER
EGG WHITES
MILK OF MAGNESIA
LAUNDRY AMMONIA
LIMEWATER
LIQUID DRAIN CLEANER
Let's Try It... and See What Happens!
by Jane Snell Copes
© 1997 Science Museum of MN
available from ASTC.org
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Putting Colors Together
The Artsy Parts of Science

What you need:
- red, blue, and yellow food colors
- 3 plastic cups of water
- 3 droppers
- plastic spot plate, a white foam egg carton, or a white ice cube tray

What's the big idea:
We mix colored solutions to make new colors. How many colors can you make from red, blue, and yellow in various proportions?

What to do:
- Add food colors to 3 cups of water to make fairly deep shades of red, blue, and yellow. Put a dropper in each color, and try not to mix the droppers up.
- You may need to show younger children how to use droppers. Fill the dropper with liquid so there are no air bubbles in the stem. Practice making single drops with the dropper. To do this, try not to let air back into the dropper stem. A drop is NOT a squirt!
- Mix colors in a spot plate or ice cube to make new colors. Count drops and name your new colors.
- Please empty your tray and rinse it when you change stations.

# B	#R	# Y	new color name

What else?

To make black, you usually need an opaque pigment like small carbon particles.

Little Blue and Little Yellow by Leo Leoni

Mouse Paint by Ellen Stoll Walsh

Blue Goose by Nancy Tafuri

Why does it work?
Food colors are chemical compounds with known molecular structures. A blue solution appears blue because it absorbs light of all other colors and lets the remaining blue light show through. These color changes are **physical changes** caused by mixing the solutions together.

Play Clay

The Artsy Parts of Science

What you need:

- 1 cup unbleached flour
- 1 cup salt
- 1 Tablespoon alum
- ½ cup water
- food colors or poster paint
- mixing bowl
- mixing spoon
- zipper bag

What else?

Students can work out the best proportions of ingredients for this clay, but insist that they measure and record their results.

You will get very different textures if you add water to flour or water to salt, instead of following the directions.

What's the big idea:

This uncooked salt dough is very easy for kids to mix and work with. You can tint the dough with paints or food colors. It stays soft if you keep it in a zipper bag. You can also let the dough dry and paint it later.

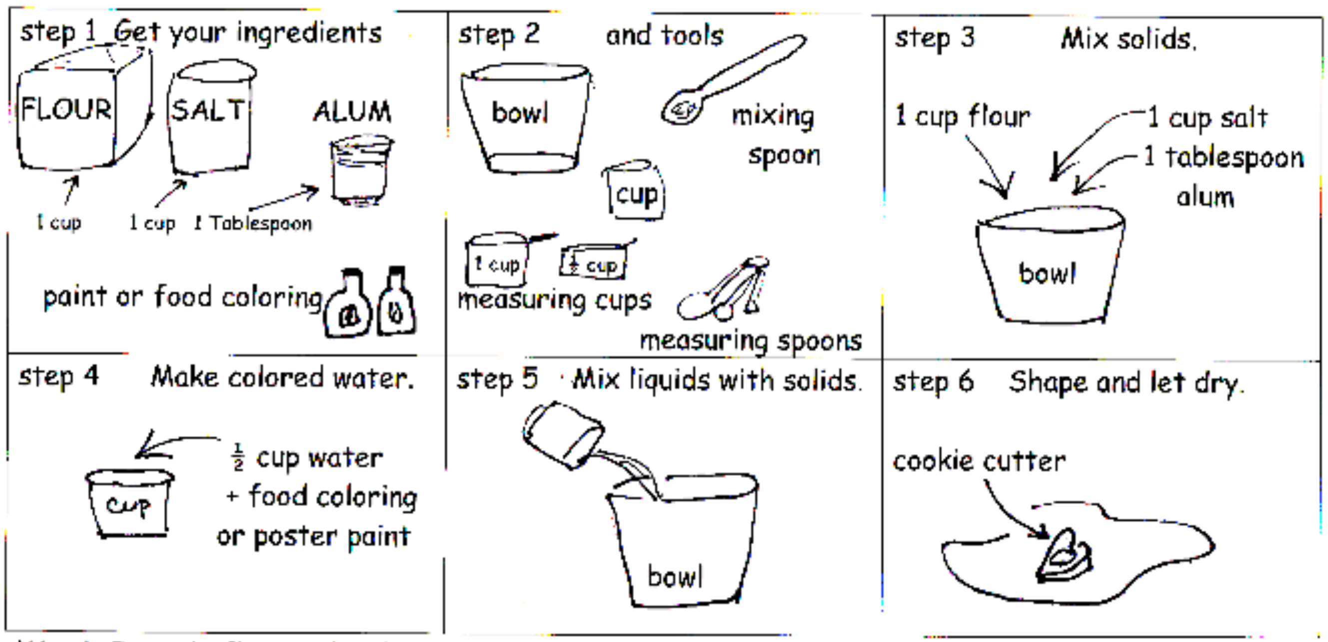
What to do:

- Measure solids into a bowl and mix them with a spoon.
- Color the ½ cup of water with food color or paints to get the color you want.
- Mix about half of the colored water with the powders. Stir well. Add the rest of the water and knead with your hands.
- You can play with the samples I brought and make yours at home.
- This recipe makes a generous amount of clay. Encourage students to make several colors and trade lumps with each other.

A few details

- You can get alum in the spice section of the grocery store. A small container holds about 4 Tablespoons. It will be the most expensive ingredient in the clay. Many food coops have bulk alum at a better price.
- 5 pounds of flour measures about 20 cups.
- A 4 pound box of canning salt contains about 6 cups.

____________________'s Directions for _______Making Play Clay _________



Words I need: flour, salt, alum, water, cup, tablespoon, bowl, spoon, solid, liquid, mixture

Oobleck
The Artsy Parts of Science

What you need:

- 1 pound box of cornstarch
- 1 $\frac{1}{4}$ cup water
- food coloring
- large bowl or plastic container you can get your hands into
- mixing spoon
- table protection

What else?

Bartholomew and the OObleck, by Dr. Seuss.

Pure Slime by Brian Rohrig

Quicksand is made of very smooth grains of silica sand mixed with water. The more you struggle in it, the more it traps you. Apparently, you should lie flat on your back and float on the quick sand. Then roll to safety!

What's the big idea:
It's ooey and gooey. Oobleck is just cornstarch and water and a little food coloring.

What to do:

- Put water in the bowl or other container. Tint it with your favorite color. Green is traditional, but other colors are fine.
- Sprinkle in corn starch and stir.
- Go ahead and get your hands into it! What happens when you push HARD on the oobleck?
- Grab a handful of oobleck and let it rest on your palm. Ooey!
- To clean up, just brush off your hands over the oobleck container.
- You can store oobleck in a covered container or put it in the trash. Kids do like to take it home.

Why does it work?
Is it a solid or a liquid? Yes!

This goo is called a non-Newtonian fluid. It gets stiffer or more viscous when you press it harder. It becomes more like a liquid when you let it relax.

Colors in Bubbles
The Artsy Parts of Science

What you need:
- $\frac{1}{4}$ cup dish washing liquid
- 3-5 cups water
- storage container
- flat pans
- trays
- drinking straws or coffee stirrers
- string
- floor protection

What else?

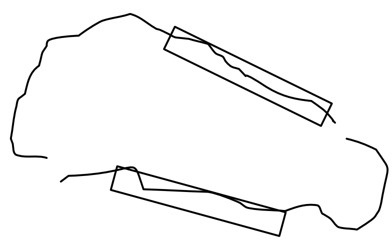
Some folks add glycerin or corn syrup to bubble juice. I don't think you need them.

Have a contest to see who can make the longest-lasting half-bubble.

Blow bubbles outdoors when it is very still but below zero. It's amazing!

What's the big idea:
We make thin, thin films of water with the help of a little detergent.

What to do:
- Make your Bubble Juice: Gently mix dish washing liquid with 3 cups water in a big pan. Try not to make a bunch of foam. This is a 1:12 dilution. Test the "bubble-ability" of the Juice. If bubbles break too quickly, add more water not more soap.
- Put a shallow layer of Bubble Juice on a tray. Use a straw to blow big half bubbles. Keep your own straw, please!
- Watch the colors as the bubble "ages".
- If your finger is wet with Bubble Juice, you can stick it through a bubble without breaking it.
- Try the straw-and-string bubble makers in a pan of Bubble Juice.



Hold the straws parallel and together in the Juice. Lift them together before you pull them apart and launch your bubble.
- Bubble Juice lasts practically forever, so store it in a labeled container.
- Please help clean up!

Why does it work?
We see rainbow colors in bubbles because white light is bent and separated into a spectrum by the two sides of a bubble film.

Water sticks to itself very strongly—that's called surface tension. Soaps and detergents make water "wetter" or stretchier because they lower its surface tension.