Activity Book

BASF
We create chemistry

Greetings *young scientists!*

Welcome to BASF's awesome Activity Book! Each page is loaded with engaging experiments, challenging puzzles, and lots of cool chemistry coloring pages. At BASF, we create chemistry for a sustainable future! We hope this guide inspires you to see how chemistry is all around us and discover how fun and exciting science can be!

Do you like solving puzzles? Then check out pages 34 and 35 to test your problem-solving skills. Like experimenting and making discoveries? Then, check out our bubbles experiment on page 4. And, when you're done, flip to page 16 and try your hand at making our Kids' Lab classic: Playful Polymers!

For our artists, enjoy coloring BASF's favorite shape-shifting ambassador, morpH, as he explores the world around him. Turn to page 22 to see our lucky morpH under a rainbow, or page 26 to see him take to the seas!

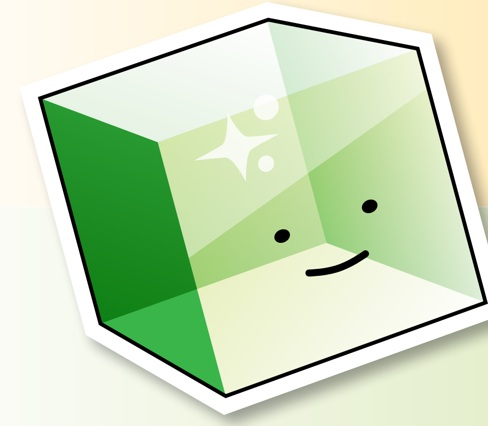
We hope you enjoy creating chemistry with BASF and exploring the science in the everyday items around you. Stay connected with us by liking **@BASF.ScienceEd.NorthAmerica** on Facebook for more science content and to learn about activities BASF is doing in your community!

Table *of Contents*

EXPERIMENTS

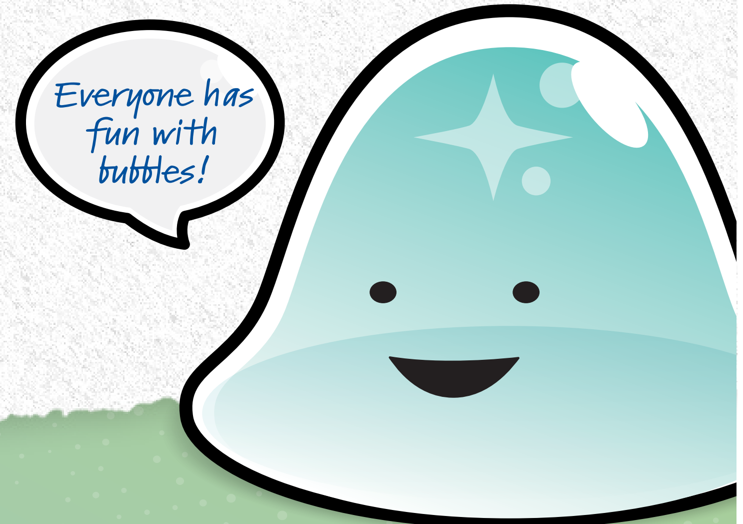
COLORING PAGES

ACTIVITIES



Bubbles, Bubbles **Everywhere!**

Did you know that bubbles are made from chemistry? In this experiment, we will make our own bubble solution and explore the scientific properties of bubbles.

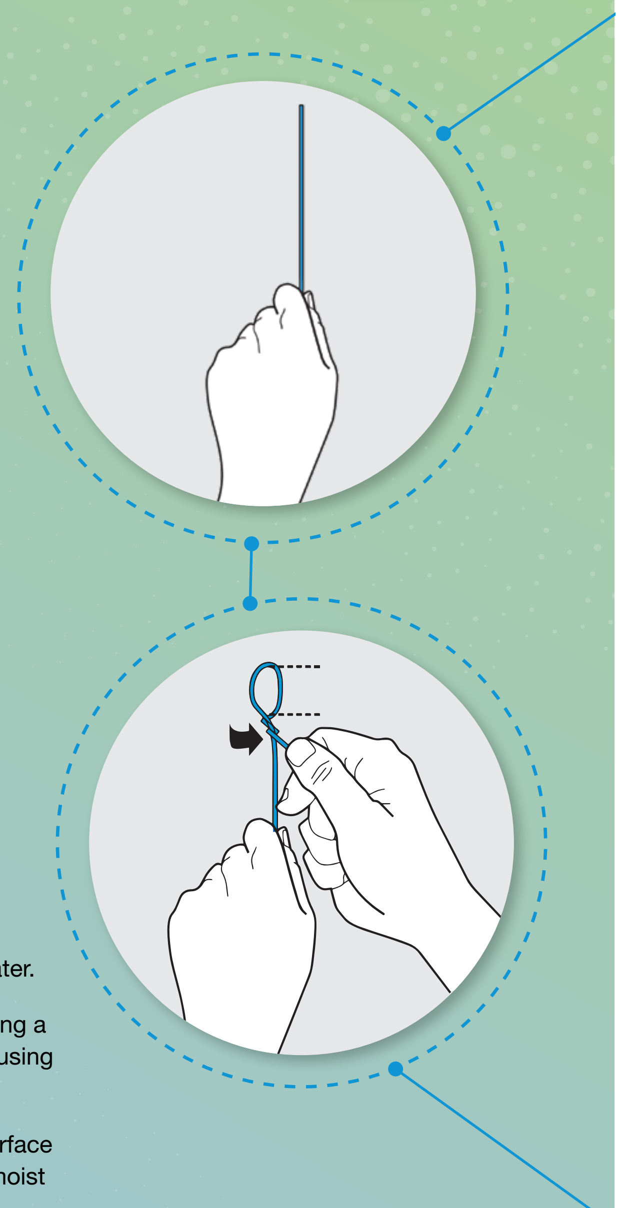


Materials

- 1 cup plus 2 tablespoons of water
- 1 measuring cup
- 1 measuring spoon (1 tablespoon)
- 1 water bottle (8oz.)
- 1 small funnel
- 1 felt stem or pipe cleaner
- 1 tablespoon of glycerin
- 2 tablespoons of liquid dish soap

Instructions

1. Pour 1 cup (8 oz.) of water into a measuring cup.
2. Add 2 tablespoons of liquid dish soap to the cup.
3. Add 1 tablespoon of glycerin to the cup.
4. Add 2 more tablespoons of water to the cup.
5. Stir gently.
6. Use the funnel to pour the mixture into an empty 8 oz. water bottle.
7. Make a bubble wand by bending a felt stem in half (pictured on the right). Twist the ends together to form a stem leaving a ½ inch opening at the top to form a loop.
8. Dip the loop into the bubble solution and blow your own bubbles!
9. Have fun!



WHAT'S HAPPENING?

Bubbles are really a pocket of air covered by a thin membrane of soapy water.

The slippery texture of the soapy water glides around the trapped air creating a bubble. Eventually, the soapy membrane loses its elasticity and breaks, causing the bubble to pop.

The swirling colors in bubbles are caused by light refracting through the surface of the bubble, like how a rainbow forms when the sun shines through the moist air after it rains.

Energy **Loves Produce**

Electricity is energy made available by the flow of electric charge through a conductor. In this experiment, we will use a lemon to generate power by immersing a pair of connected zinc and copper plates in the lemon.

Materials

- Copper hobby wire
- Pennies (use ones made before 1982)
- Galvanized nails
- Alligator clip leads
- Produce (lemons, oranges, potatoes, etc.)
- LEDs

Instructions

1. Place 1 nail and 1 copper wire or penny firmly into the skin of the produce, about 1 inch apart.
2. Use the alligator clip leads to arrange the produce into a series. (You should have 1 free end of a lead whose other end is attached to a nail and 1 free end of a lead whose end is attached to a penny.)
3. Connect the free end of the lead attached to the copper wire with the long lead of the LED.
4. The LED should light up!
5. **If it did not light:**
   - You might not have enough produce in the series.
   - Check that all connections are correct and secure.
   - Use a voltmeter to check and see how many volts your produce is producing.
   - Try a new LED.

WHAT'S HAPPENING?

When the metals are immersed in the electrolyte (the liquid in the lemon, orange, potato, etc.), a chemical reaction occurs. The acid in the electrolyte breaks down the atomic structure of the copper and zinc, causing individual electrons to be released. Zinc is a more reactive metal than copper in this chemical process. It generates electrons faster than the copper in this chemical process. The excess electrons flow from the zinc plate to the copper plate. This flow of the electrons from a reactive metal to a less reactive metal forms a small current that travels through the wires and is strong enough to power a small light bulb or a small kitchen timer.

Want to know more?

Oranges, lemons and other citrus fruits have citric acid present. This citric acid enables the breakdown of copper and zinc.

Is this true for potatoes? No. The potato has mild phosphoric acid content H_3PO_4.

Reduction takes place at Cu (copper) electrode:
2H+ + 2e- -> H2 gas

Oxidation takes place at Zn (zinc) electrode:
Zn -> Zn++ + 2e-

Chemistry is **Bananas!**

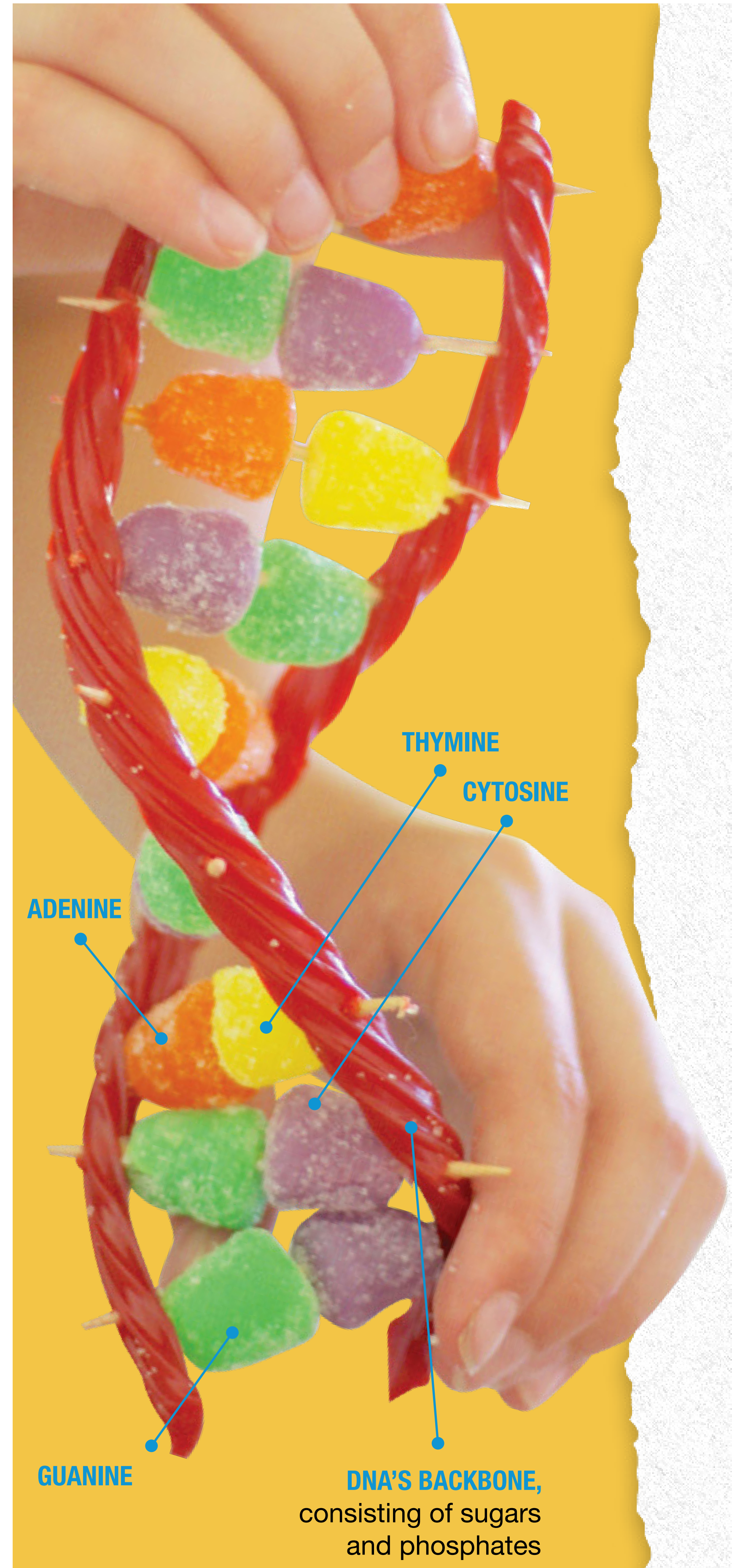
DNA is found in the cells of every living organism! It is incredibly small, but we can see it by extracting DNA and isolating chains of DNA. In this experiment, we will extract DNA from a banana.

Materials

- Cold rubbing alcohol
- Quart size press-and-seal bag
- Measuring cup
- ½ teaspoon for measuring
- ½ cup of water
- Sieve
- 1 Erlenmeyer flask
- Ripe banana
- ½ (2.5 mL) teaspoon clear dishwashing liquid
- ½ (2.5 mL) teaspoon table salt
- Funnel
- Test tube (or narrow jar)
- Stirring rod

Instructions

1. Chill a bottle of rubbing alcohol by placing it in a freezer for 10 minutes or more.
2. Peel a ripe banana. Discard the peeling and place the banana in a quart size press-and-seal bag.
3. To the bag, add the following: ½ cup of water, ½ teaspoon (2.5 mL) of clear dishwashing liquid and ½ (2.5 mL) teaspoon of table salt.
4. Seal the bag, and then with your hands, gently squeeze the bag until the banana is smashed into a mush.
    - **DO** make the banana as mushy as possible.
    - **DON'T** make soap bubbles, so do not shake the bag.
    - **DO** let the mushy banana sit for at least 5 minutes.
5. Place a clean funnel on a clean Erlenmeyer flask. Place a sieve over the funnel.
6. Pour the banana mixture through the sieve so the liquid flows through the funnel into the flask.
7. Continue until the flask contains about ½ inch of filtrate.
8. Fill a test tube about ¼ full with the banana filtrate.
9. Add cold rubbing alcohol to the tube containing the banana filtrate. You want equal amounts of filtrate and alcohol.
    - Tilt the test tube so that the alcohol runs slowly down the side of the tube. You do not want the alcohol and filtrate to mix.
10. Stand the test tube upright and periodically observe the area for 5 minutes or more where the top layer of alcohol touches the bottom layer of banana filtrate. You will see the clear/white DNA precipitate into the alcohol layer.



Experiment and photo source: *Little Bins for Little Hands*

While we wait for the DNA to precipitate, let's create a model of DNA.

Materials:

- Twizzlers (represent DNA's backbone, consisting of sugars and phosphates)
- Toothpicks
- Soft Candy (Something that comes in 4 colors but is the same type of candy to represent the A, T, C, G nucleotides)
- 4 cups to separate candies by color

Instructions

1. Sort the 4 colors of soft candy into separate bowls and assign each color to a specific nucleotide.
    - Adenine
    - Thymine
    - Cytosine
    - Guanine
    - **Remember:** *Adenine and Thymine are always paired together. Cytosine and Guanine are always paired together.*
2. Start placing the pairs of soft candy that represent the nucleotide pairs onto the toothpicks to begin building your candy DNA model.
3. Construct your own unique strand of candy DNA by attaching two Twizzlers to the ends of the toothpicks of your soft candy pairs. There are endless combinations that can be made!
4. Twist your strand of candy DNA into a double helix.

WHAT'S HAPPENING

Basic chemical techniques can be used to isolate DNA from a banana. DNA is not something that the naked eye can see unless it has been extracted.

Create a **Chromatography Butterfly**

Did you know that most inks are not made of one but many colors? In this experiment we blend art with science to make colorful butterflies!

EXPERIMENT

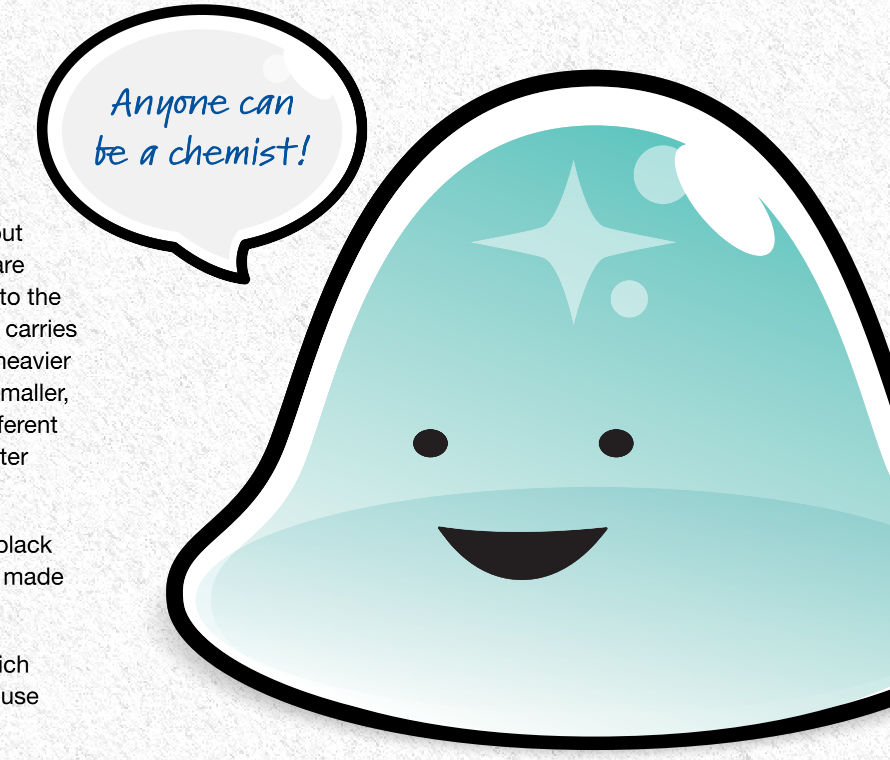
Materials

- Coffee filters
- Felt-tip pens or dry-erase whiteboard pens, but not permanent markers
- Pencil
- Popsicle sticks or clothespins
- Small cup for water
- Googly eyes
- Pipe cleaners
- Scissors
- Water
- Glue

Instructions

1. Use the felt-tip or whiteboard pens to draw some lines and dots at the base of the filter paper on both sides. It's a good idea to write in faint pencil underneath what colors you used.
2. Put the filter paper in very shallow water and watch. What happens?
3. Take the filter paper out and put it somewhere to dry.
4. Once you've got a few filter papers done and fully dry again, grab your craft materials.
5. Cut the edges off the filter papers to open them out and make some chromatography butterflies!

Experiment and photo source: *Small Science Club*



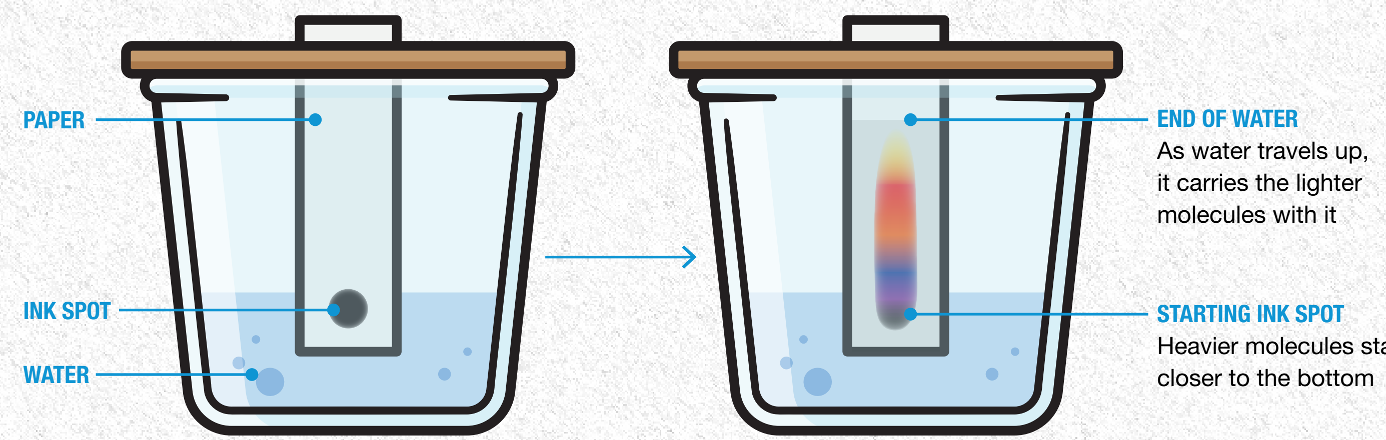
WHAT'S HAPPENING?

The ink in your pens often isn't a single color but is made of several colorful chemicals that we are separating out again. When the water soaks into the filter paper by capillary action, it dissolves and carries some of the ink molecules with it. The bigger, heavier molecules in the ink don't move as far as the smaller, lighter ones so they move with the water at different speeds and settle in different places as the water travels upwards.

You will probably find that the darker inks like black and brown work best because they tend to be made of many more colors.

This is the basis of paper chromatography, which is one of the most useful techniques chemists use to separate chemicals from a mixture!

Paper Chromatography



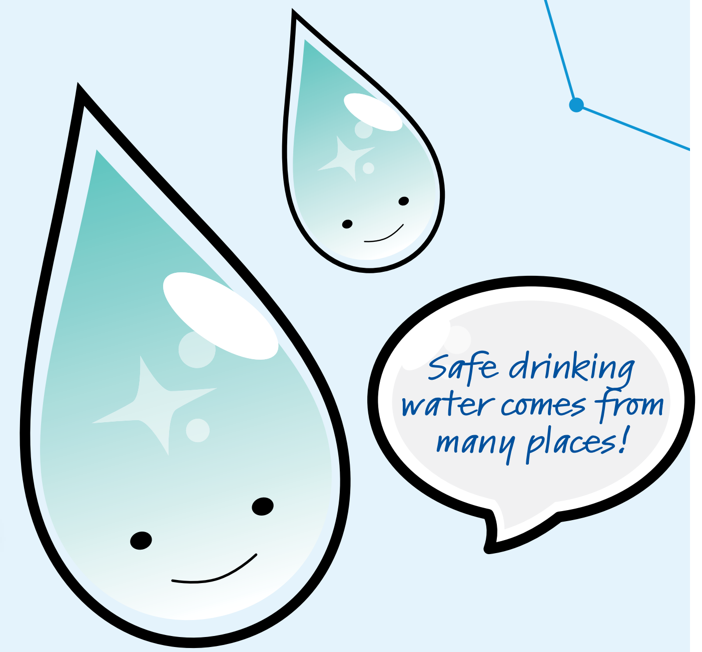
WHAT IF…?

Try this experiment again at home. What would happen if you:

- Used **permanent markers** in place of felt-tip or whiteboard pens?
- Used **cooking oil** instead of water?
- Made the **paper wet at the top and bottom** at the same time?
- Used pens of **different brands?**

Operation **Filtration**

Have you ever wondered how people get clean water that is safe to drink? There is the same amount of water on Earth today as there always has been. Water keeps moving around in an endless cycle called the water cycle. In this experiment, we will learn how to clean our water.



Materials

- 1 empty 400mL beaker
- 1 400mL beaker with approximately 150mL of tap water
- 1 plastic stirring rod
- 2 250mL Erlenmeyer flasks
- 2 large funnels
- 3 pieces of large filter paper (15cm works well)
- 1 black wet-erase overhead marker
- 3 small polypropylene cups (medicine cups)
- 1 teaspoon of sand in small polypropylene cup
- ¼ teaspoon of confetti in small polypropylene cup
- 1 teaspoon of Activated Charcoal in small polypropylene cup (charcoal used for aquarium filters works well)
- 1 strainer

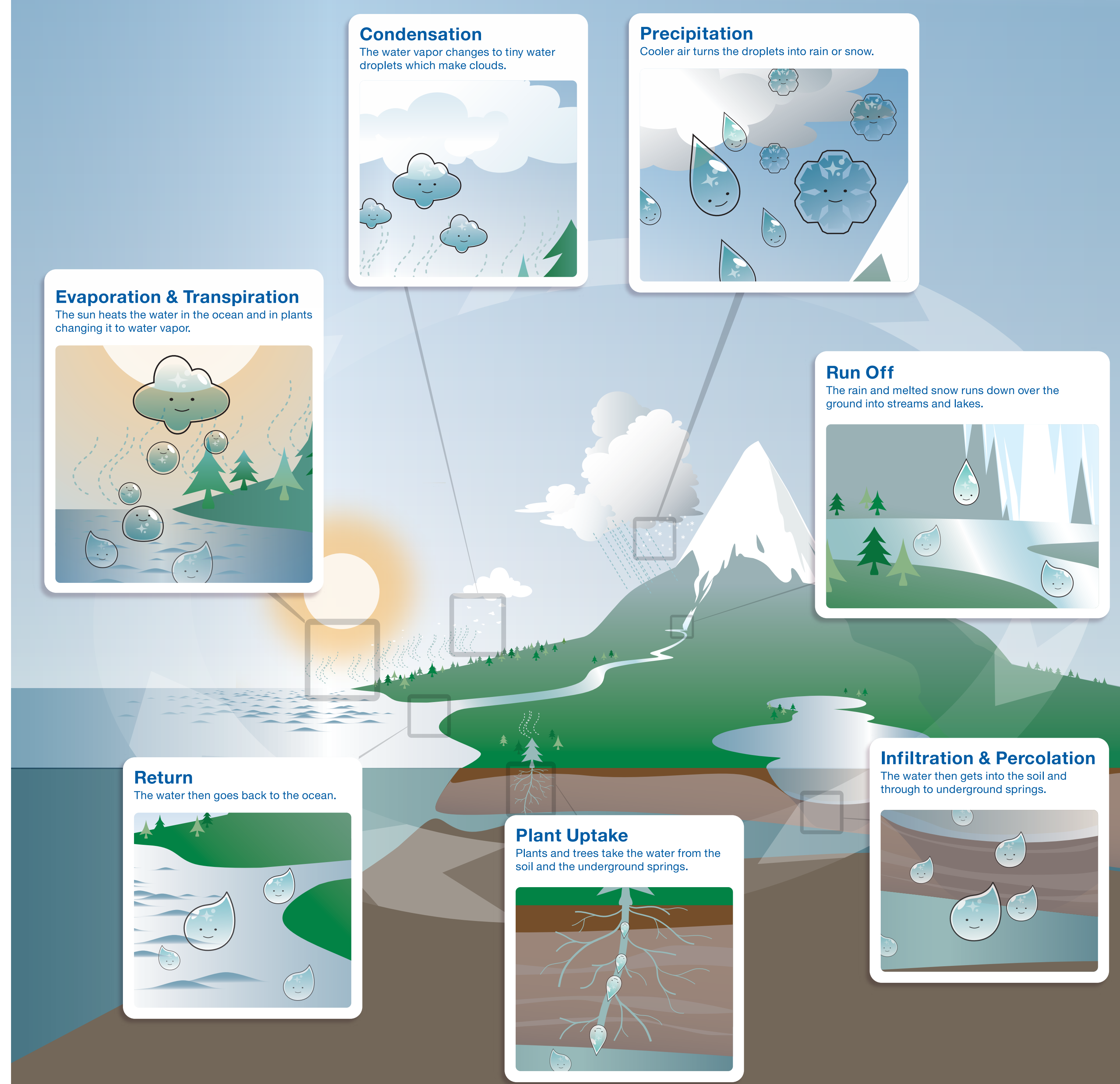
Instructions

1. Use the wet erase marker to color in the inside bottom of the empty 400mL beaker completely.
2. Transfer the 150mL of water into the beaker and stir — Instant dirty water!
3. Pour 1 teaspoon of sand and ¼ teaspoon of confetti into the beaker and stir well.
4. Place a strainer on top of the empty 400mL beaker and pour the water mixture through the strainer. **What happened? Was anything removed?**
5. Remove the strainer. Arrange a funnel and filter paper in an Erlenmeyer flask. Pour the mixture through the filter paper. Observe what happens. What is filtered out?
6. Pour 1 teaspoon of activated charcoal into the Erlenmeyer flask that now has the colored liquid in it and stir the water vigorously for a few minutes with the stirring rod (approximately 3–5 minutes). ***It is extremely important to stir for the entire time.**
7. Arrange a second funnel, filter paper, and Erlenmeyer flask system. Slowly pour the water mixture through the filter paper *(using 2 sheets of filter paper enhances the results).* **What did you observe?**

WHAT'S HAPPENING?

Everyone needs a great deal of water each day to wash and cook with and drink. Like the dirty water produced in the experiment, this creates wastewater that contains various impurities. The wastewater we create goes to a municipal water treatment plant, where it is filtered and cleaned in several steps. These steps include filtration to remove large particles like what we did with the filter paper. Materials like the activated charcoal are also used to remove some of the tiniest, microscopic impurities from the water before we can use it again.

In nature, the Earth's water cycle purifies water as it passes through its states of matter from a solid, liquid and gas. **Let's look at the water cycle and see if we can figure out how that happens.**



The **pHun Factor**

Did you know that fruits, vegetables and flowers are natural pH indicators? In this experiment, we will test the pH of household products using pH paper and create a natural pH indicator using red cabbage juice.

Materials

- Tray
- Experiment place mat (on page 14)
- 6 small polypropylene cups
- Waste container
- pH test paper
- Household solutions with pipettes
- Hot pot to boil water
- Pitcher to steep red cabbage leaves
- 1 head of red cabbage
- Pipette to use with cabbage juice
- Pen or pencil to record results
- pH Indicator Chart
- Red cabbage indicator chart

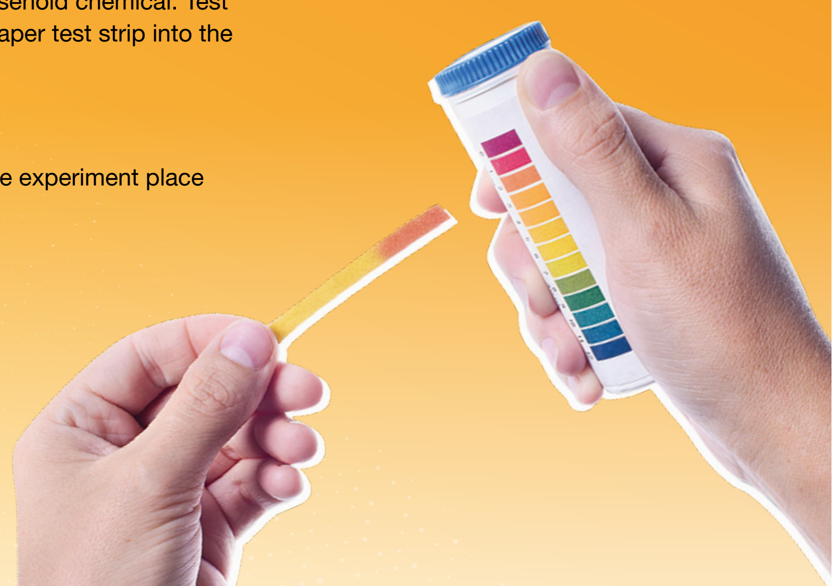
Instructions

Method 1: Determining pH using pH paper

1. Set up each of the household chemicals on the corresponding circle on the experiment place mat.
2. You will have 6 pH paper test strips, one for each household chemical. Test each of the household chemicals by dipping the pH paper test strip into the cup with the chemical.
3. Compare the color change to the pH indicator chart.
4. Record the pH test number below that chemical on the experiment place mat with a pen or pencil.

   The pH scale ranges from 0–14.

   - 0–6: Acidic
   - 7: Neutral
   - 8–14: Basic
5. Are your household solutions basic or acidic?



Method 2: Determining pH using a Natural Indicator

***Ask an adult to assist in boiling water in a hot pot.**
Tear off leaves of red cabbage. Place the leaves in a plastic pitcher and cover them with boiling water. Steep until the liquid is purple.

1. Separate the red cabbage indicator into as many cups as you have solutions to test.
2. Add one solution to each beaker of cabbage to observe a color change, if any.
3. Compare the color change to the red cabbage indicator chart.
4. Record the pH number below the chemical on the experiment place mat with a pen or pencil.

   The pH scale ranges from 0–14.

   - 0–6: Acidic
   - 7: Neutral
   - 8–14: Basic

   How basic or acidic are your household solutions?

WHAT'S HAPPENING?

There are many indicators of pH value. One is red cabbage solution, which contains anthocyanin. The color of this compound depends on pH range. With this solution, you can observe the different characteristics of many things around you, and whether they are acidic, neutral or basic.

Some chemicals are pH dependent, and if a chemical has such a characteristic, you can always use it as an indicator. Color from anthocyanin can be found in fruits, vegetables and flowers and can be used to make pH indicators.

One characteristic of anthocyanin is that the color changes easily with variations in acidic or basic levels. When you make strawberry jam at home, you will add lemon juice. What happens after you add it? The color turns a brighter red. This comes from a reaction between anthocyanin and the acid in the lemon juice.

pH INDICATORS IN NATURE

FRUITS
Grapes
Blueberries
Strawberries
Cherries

VEGETABLES
Eggplant
Taro
Red cabbage
Carrots
Beets
Red onion

FLOWERS
Hydrangea
Morning glory
Geraniums

Red Cabbage Juice
Acid–Base
Indicator pH Chart

1-2
3
4
5
6
7
8
9
10
11-12

Orange Juice

Baking Soda

Vinegar

0-6 = Acid

7 = Neutral

8-14 = Base

Windex

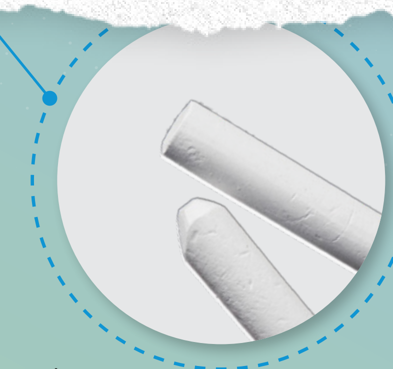
Water

Sprite

The Rainbow Connection:
Chalk Chromatography

Chromatography is the process used to separate the substances contained in a compound substance into individual components. All the chromatographic processes used today work based on two phases, the stationary phase and the mobile phase. Today, we will experiment with the chromatographic separation of different felt-tip pen colors.

EXPERIMENT



Materials

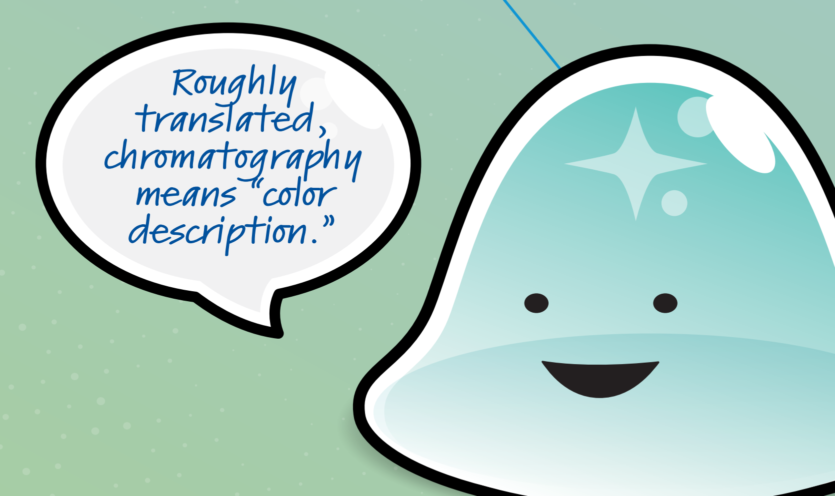
- White chalk
- Markers
- 50mL beaker with approximately 10mL of tap water

Instructions

1. Take a piece of chalk and mark it with a ring 1 inch from the base with a marker.
2. Put the chalk in the water with the mark closest to the water.
3. Leave the chalk to absorb the water.
4. Remove the chalk when you see the colors move halfway up the chalk (the colors will continue to move after the chalk is out of the water).

WHAT'S HAPPENING?

Chalk chromatography is **a simple separation method used to distinguish between different pigments in a dye or ink.** The pigment molecules separate based on their size, which affects how quickly they can be drawn up porous chalk by a solvent, in this experiment, water.



Playful Polymers

Slime science starts with the best slime ingredients including the right kind of glue and the right slime activators. One of the best glues to use is a polyvinyl-acetate a.k.a. washable school glue.

There are several slime activators to choose from (all in the boron family). These include saline solution, liquid starch and borax powder, and all contain similar chemicals for making a slime substance. Cross-linking is what happens when the glue and activator are combined!

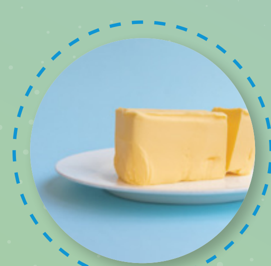
WHAT IS SLIME?

Slime involves chemistry! Chemistry is all about states of matter including liquids, solids and gases. It is all about the way different materials are put together, and how they are made up of atoms and molecules. Additionally, chemistry is how these materials act under different conditions.

Slime is a non-Newtonian fluid. A non-Newtonian fluid is neither a liquid nor a solid. It can be picked up like a solid, but it also will ooze like a liquid. Slime does not have its own shape. You will notice your slime change its shape to fill whatever container it's placed in. However, it can also be bounced like a ball because of its elasticity.

Pull the slime slowly and it flows more freely. If you pull it quickly, the slime will break off more easily because you are breaking apart the chemical bonds.

Oobleck
(Cornstarch and Water)



Butter

Quicksand

WHAT MAKES SLIME STRETCHY?

Slime is all about polymers! A polymer is made up of very large chains of molecules. The glue used in slime is made up of long chains of polyvinyl-acetate (PVA). These chains slide past one another fairly easily which keeps the glue flowing.

Chemical bonds are formed when you mix the PVA glue and slime activator together. Slime activators (borax, saline solution or liquid starch) change the position of the molecules in the glue in a process called cross-linking! A chemical reaction occurs between the glue and the borate ions, and slime is the new substance formed.

Instead of flowing freely as before, the molecules in the slime have become tangled and create what is slime. Think wet, freshly cooked spaghetti versus leftover cooked spaghetti! Cross-linking changes the viscosity or flow of the new substance.

EXPERIMENT

Materials

- 4 oz glue
- ¾ teaspoon of baking soda
- 10 mL contact lens solution
- Cup for mixing solution

Instructions

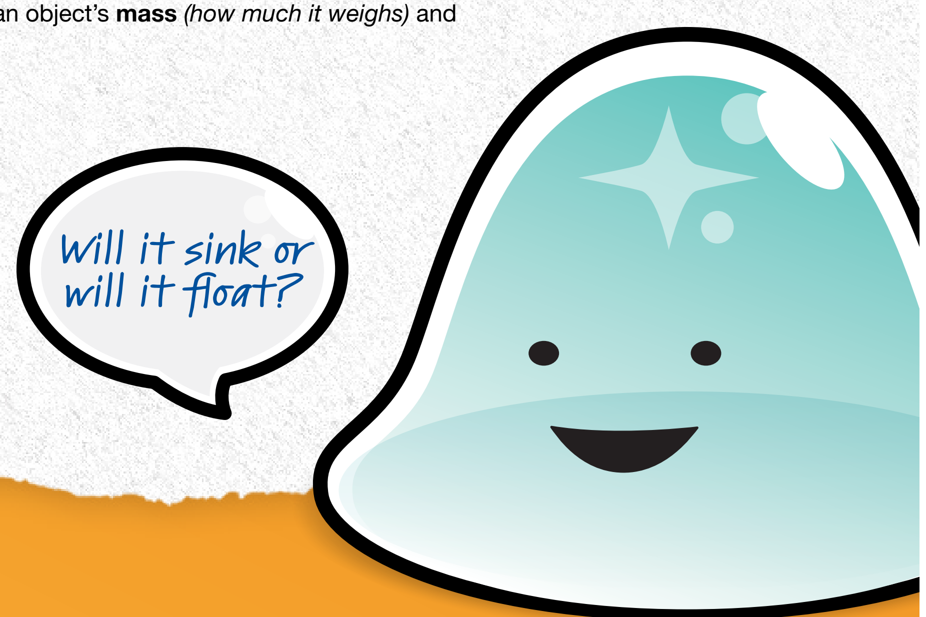
1. Add 4 oz of glue to cup
2. Add ¾ teaspoon of baking soda to cup and stir until dissolved
3. Add 10 mL of contact lens solution to cup and stir until combined
4. Take playful polymer out of cup once combined and knead and roll in hands
5. Observe your polymer. Does is stretch, ooze or flow? Does it bounce? Can you rip it apart or put it back together?

Sink or Float?

Observing the behavior of various solids and their ability to sink or float in liquids is useful to understand density.

The quantity of atoms and how closely they are arranged within an object is called its **density**. Density also calculates the relationship between an object's **mass** *(how much it weighs)* and **volume** *(how much space it takes up).*

In this experiment, we will explore the physical properties of matter through a hands-on investigation of several liquids and solids by creating a density column.



EXPERIMENT

Materials

- Tray
- Data collection sheet
- Tall, narrow, clear cylinder
- Five cups
- Vegetable oil
- Dish soap
- 100% pure maple syrup
- Light corn syrup
- Honey
- Ping-pong ball
- Plastic bead
- Cherry tomato
- Popcorn kernel
- Metal nut or bolt

Instructions

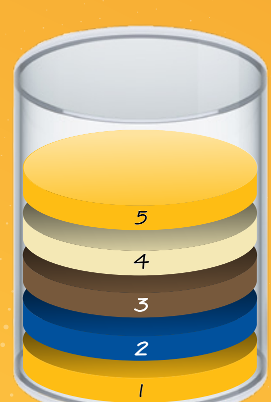
Step 1: Creating a Density Column

Start with five cups on a tray with each liquid poured into one of the cups.

Make predictions about what you will observe once you have poured each liquid into the cylinder.

Start building your density column by pouring the liquids into the cylinder.

Pour each liquid SLOWLY into the container, one at a time, in the following order:



1. Honey
2. Light corn syrup
3. 100% pure maple syrup
4. Dish soap
5. Vegetable oil

It's important to pour the liquids slowly and into the center of the cylinder. Make sure that the liquids do not touch the sides of the cylinder while you are pouring. It's okay if the liquids mix a little as you are pouring. The layers will always even themselves out because of the varying densities.

Why are these substances forming layers as they are added to the cylinder? ***Record your thoughts.***

Step 2: Add Solid Items to a Liquid Density Column

Take the various small objects and drop them into the column.

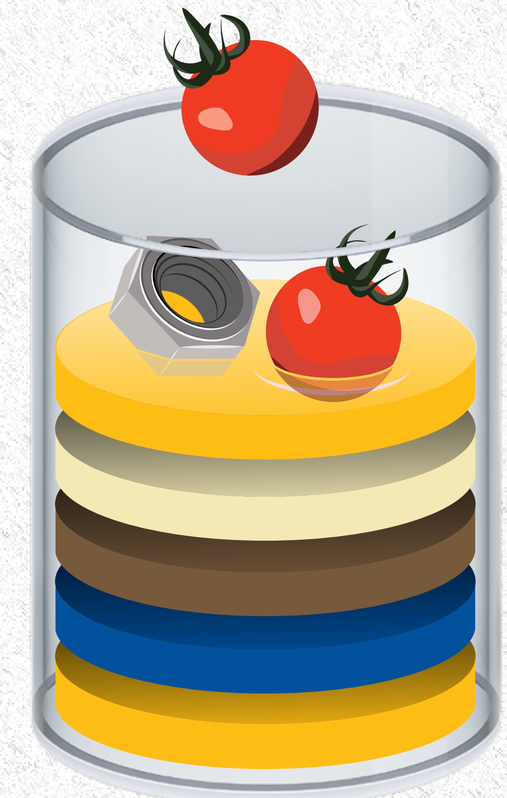
Make predictions about what you will observe once all the objects have been added to the density column.

Drop them in the following order:

1. Metal nut or bolt
2. Popcorn kernel
3. Cherry tomato
4. Plastic bead
5. Ping-pong ball

Think about what causes some objects to sink deeper into the column while some hardly sink at all.

Revisit your predictions.
Were they accurate? Why or why not?



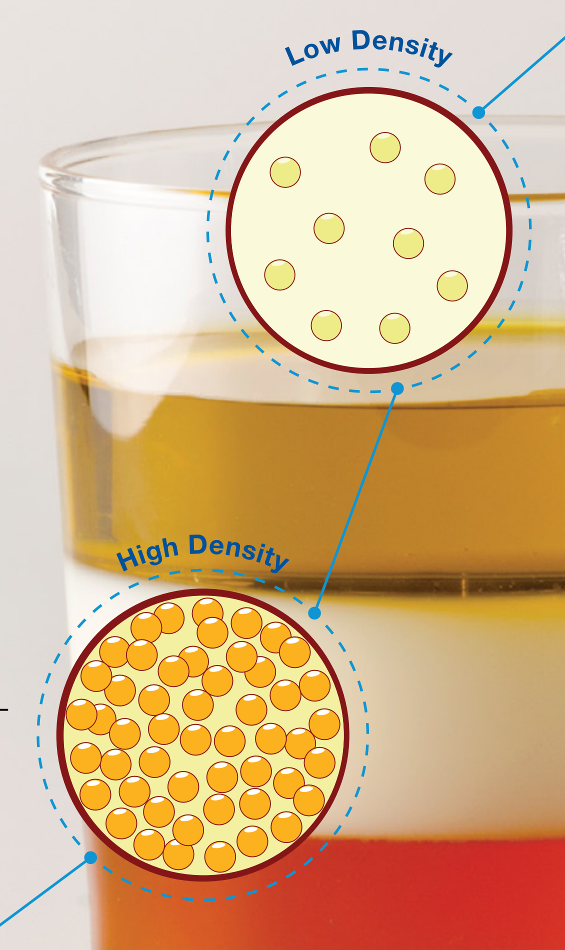
WHAT'S HAPPENING?

Different substances have different densities. These differences can affect how objects behave when placed in each substance. Density allows us to study the properties of our everyday household items.

A density column is a container of liquids stacked in layers. The layers stay separated because each substance has a different density. In other words, heavy liquids have more "stuff" or atoms smashed inside than lighter liquids, making them denser. You will notice that each of the liquids and objects will sink through or float on a different layer of the density column.

Density columns are made by layering liquids of different densities. If neighboring layers are insoluble with each other (meaning they don't mix), the column will stay in separate layers unless disturbed. The challenge arises when the layers are mixed and exposed to other layers. When this happens, the soluble layers will combine and settle into two layers: a polar **hydrophilic** "watery" layer and a **nonpolar hydrophobic** "oily" layer.

Solid items also have different densities. By adding the solid items to the liquid density column, you can observe where those items fall in relation to the liquids and other solids. Observing the behavior of all these items allows you to determine the objects' relative densities without mathematical calculations — which is the only way to determine exact density.



We Dig Soil

Soil texture is described by how it feels when it is slightly wet. Soil texture depends on the different amounts of sand, silt and clay it contains. If a soil has lots of sand, it feels gritty. If it has lots of clay, it is very hard when dry and sticky when wet. Soils with silt are neither gritty nor sticky when wet and may feel like flour. Loam soils have equal amounts of clay, sand and silt. *You will explore how different textures feel in this activity.*

Materials

- Granulated sugar
- Flour
- Modeling clay
- 4 small (10mL) cups
- Water
- Pipette

Instructions

1. Take out four cups. In each of the following:
   - Sandy Soil – Cup 1 – Add sugar
   - Clay-Like Soil – Cup 2 – Add Flour
   - Silty Soil – Cup 3 – Add Modeling clay
   - Loamy Soil – Cup 4 – Add equal bits from cups 1, 2 and 3
2. Each cup represents a different texture of soil.
3. Touch and feel the contents of all 4 cups of dry material and note your observations.
4. Now add water to each cup using the pipette. ***Be sure not to exceed the volume of the cup.**
5. Now feel the contents of all 4 cups of wet material and note your observations in the chart below.

Soil Characteristic	Sandy soils	Clay-like soils	Silty soils	Loamy soils
Allows root growth most easily				
Could be used for finger painting				
Water would drain through quickly				
Would stick to the bottom of your shoes				

SOIL SUMMARY

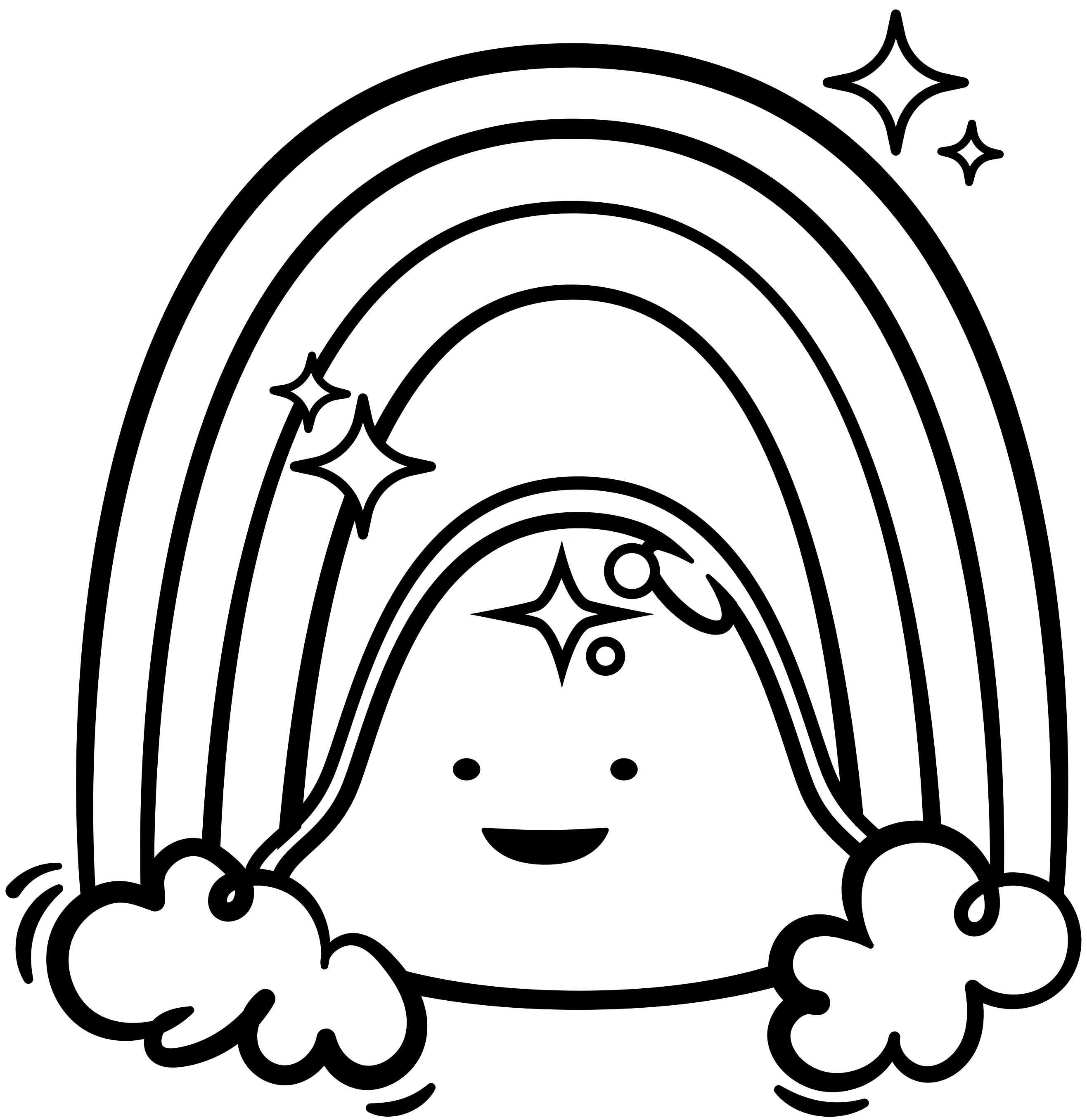
Farmers and soil scientists can tell a lot about soil by grabbing a handful and feeling it. Soils with more clay will feel sticky like peanut butter. Soils with more sand may feel very grainy, like salt or granulated sugar. Soils with more silt will feel slightly grainy, like wheat flour or powdered sugar. Soil moisture can also be estimated by feeling a handful of soil and the "ribbon test" (pushing soil between the thumb and forefinger to see if it makes a ribbon) is often used to see if the soil is dry enough for planting.

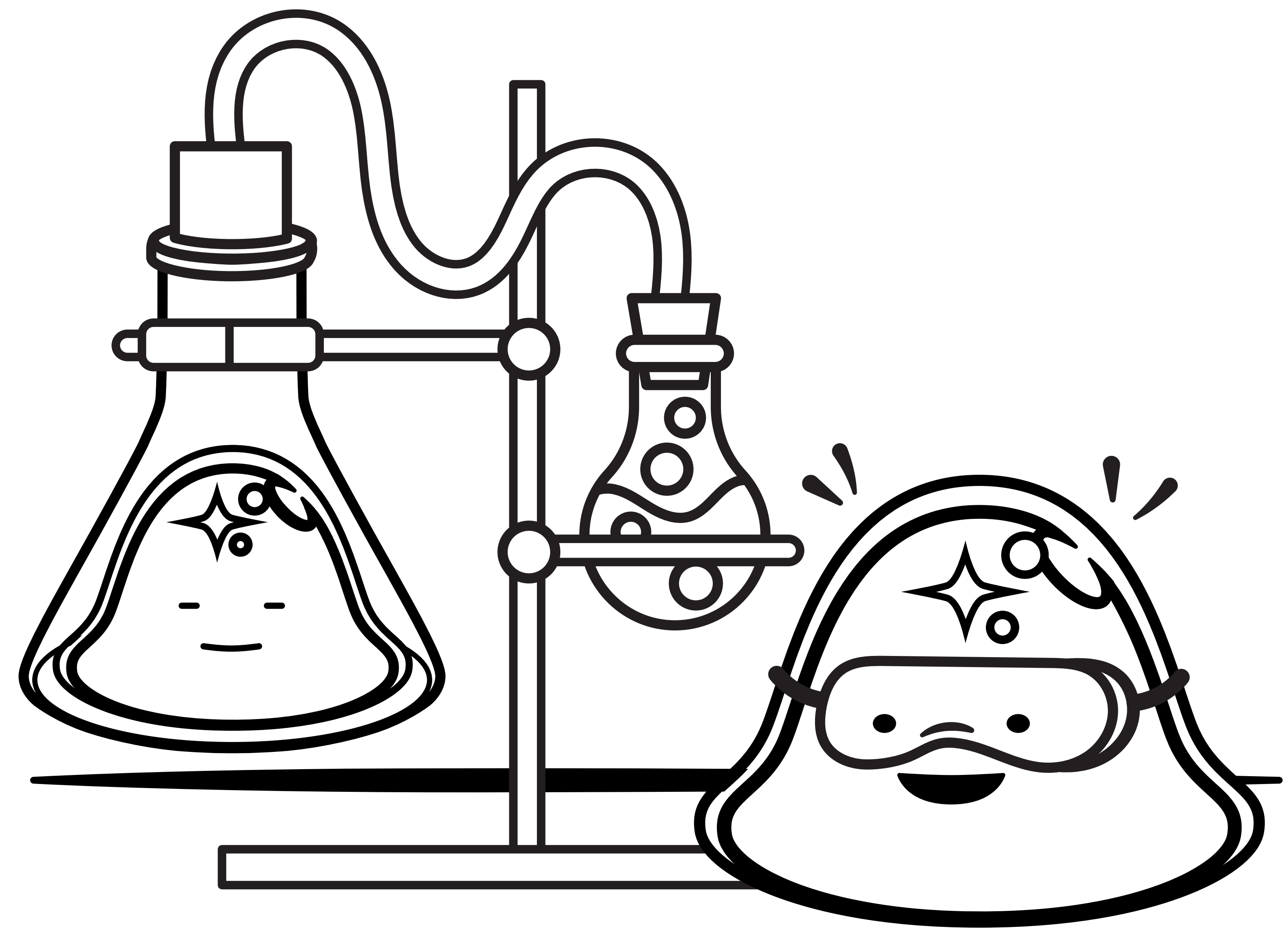
When is Soil Ready for Planting?

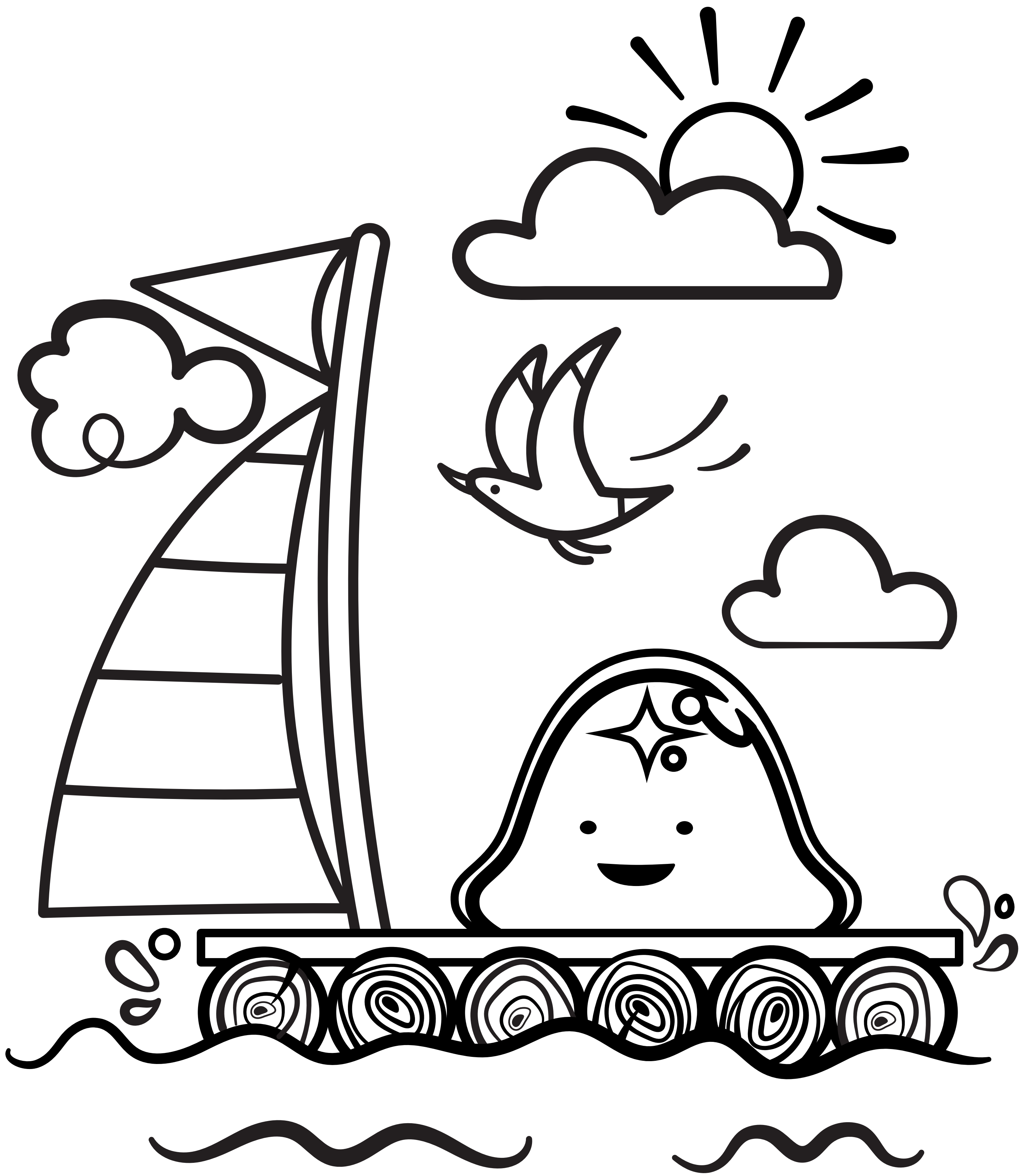
- Grab a handful of your garden soil. If you can form it into a ball, the soil is too wet for planting. If it crumbles through your fingers, it's ready for planting.
- Make a ball of soil and drop it. If the ball crumbles, your garden is ready for seeds. If it holds its shape or breaks into two clumps, it's still too wet for planting.
- You can also step into the garden and then step back and look at the footprint you've left in the soil. If it's shiny, then there's too much water near the soil's surface to dig and plant. If it's dull, excess water has drained away and it's time to plant.

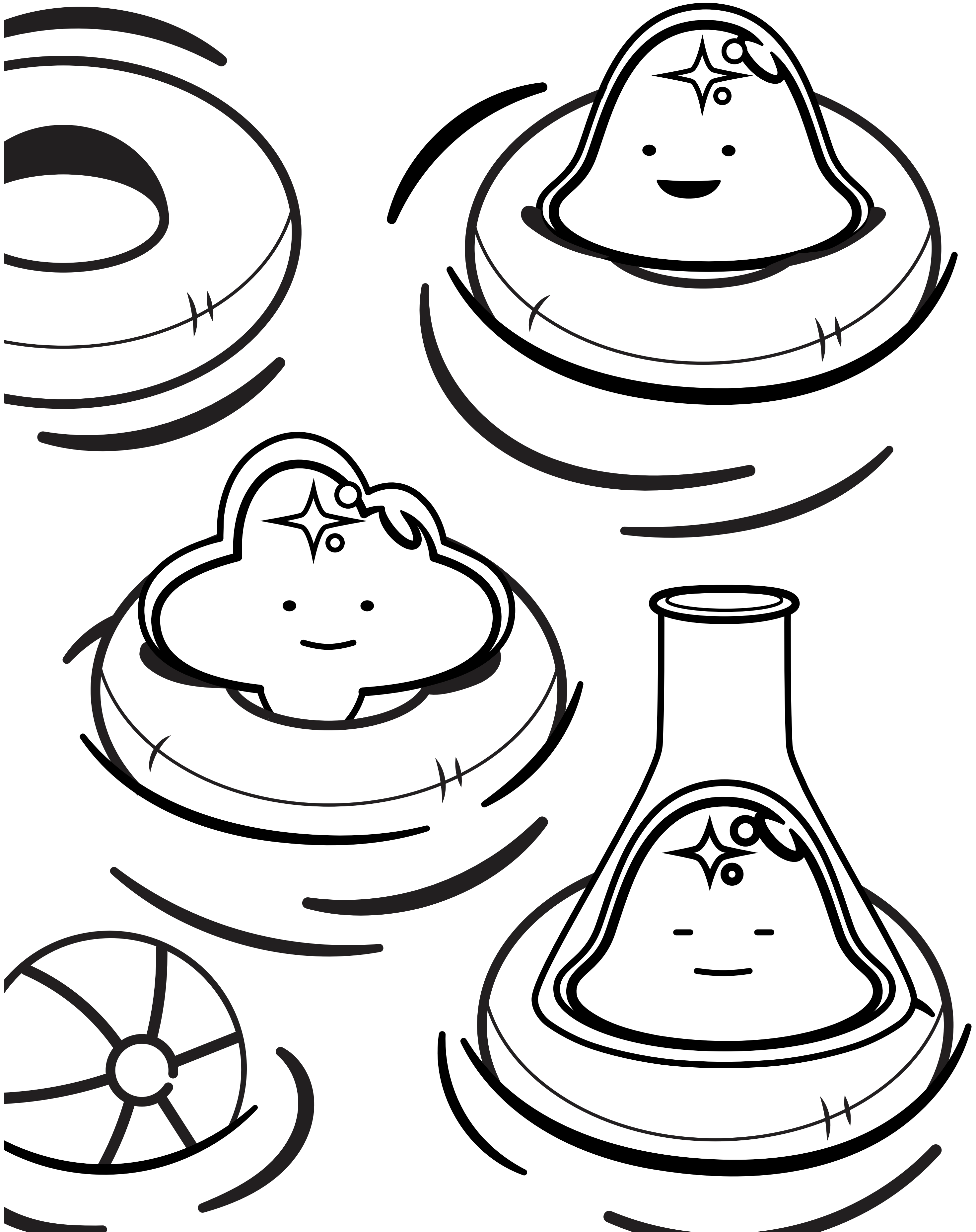
Coloring Pages

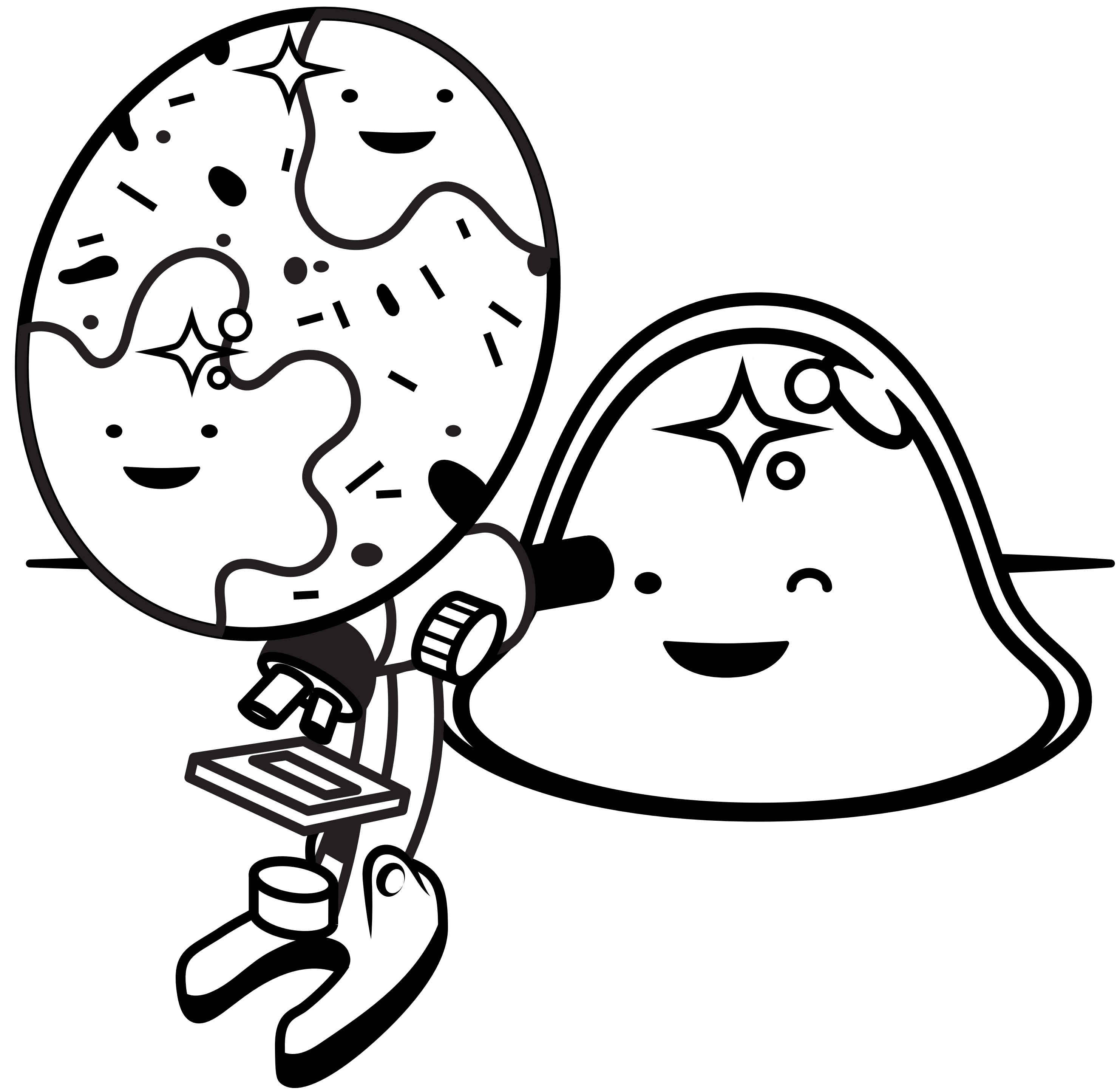
Share your finished coloring pages on our Facebook page **@BASF.ScienceEd.NorthAmerica!**

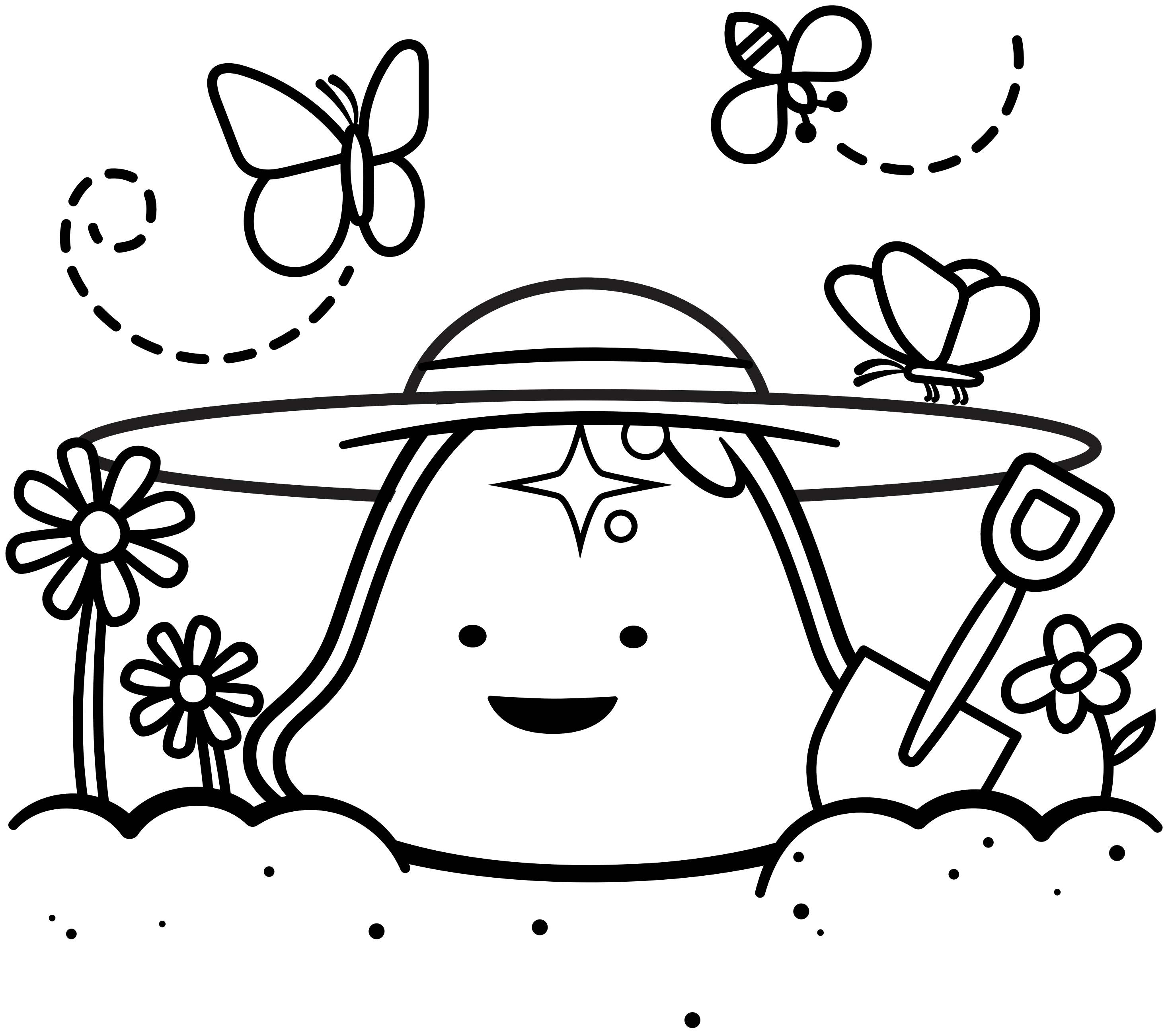






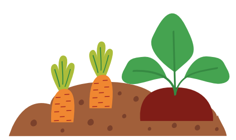
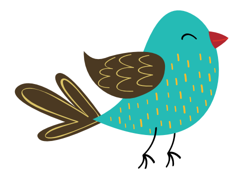
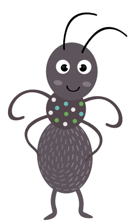
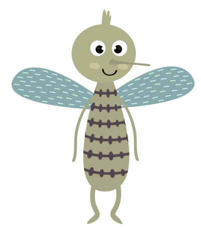
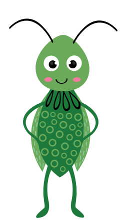
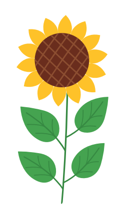
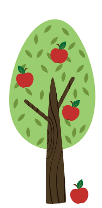
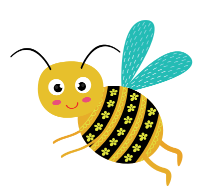
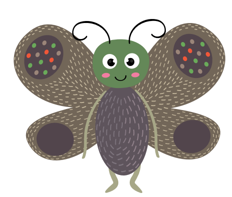






Pollinator **Bingo**

Get outside and see how many pollinators you can find! Mark off each pollinator when you see it and try to get to 'BEE-INGO.'

 Butterfly	 Vegetable Garden	 Wasp	 Bird
 Ant	 Beetle	 Mosquito	 Dandelion
 Grasshopper	 Bat	 Sunflower	 Ladybug
 Fruit Tree	 Bee	 Moth	 Spider

Word **Search**

Make sure you have everything you need for school! Find all the school supplies in the word search below and then make sure you got them all by checking the answer key at the end.

BACKPACK
BEAKER
GOGGLES
NOTEBOOK
PENCIL
PEN
PROTRACTOR
CALCULATOR
HIGHLIGHTER
PAPER
SCISSORS
MARKER
COLORED PENCILS
CRAYONS

S	M	H	Q	I	E	K	N	N	N	T	U	R	B	M
R	U	I	R	D	M	C	B	O	O	Q	E	J	X	P
E	G	G	R	H	Y	A	T	H	T	K	C	Y	L	E
K	J	H	G	J	Q	P	E	I	A	E	S	G	F	N
R	T	L	J	J	W	K	C	E	P	F	B	O	X	C
A	S	I	M	K	B	C	B	E	R	R	I	O	U	I
M	K	G	G	G	W	A	N	C	P	O	N	W	O	L
M	X	H	R	G	P	B	X	Y	R	T	K	D	P	K
R	O	T	C	A	R	T	O	R	P	A	Y	A	O	L
J	V	E	R	J	M	U	L	A	V	L	Y	K	W	P
S	Y	R	E	O	D	S	P	G	O	U	I	O	J	Z
Z	G	O	G	G	L	E	S	L	M	C	Q	K	N	K
F	Z	J	L	C	R	I	H	I	F	L	F	S	H	S
S	R	O	S	S	I	C	S	A	I	A	D	V	G	V
C	O	L	O	R	E	D	P	E	N	C	I	L	S	N

Solution | *See page 38*

Crossword **Puzzle**

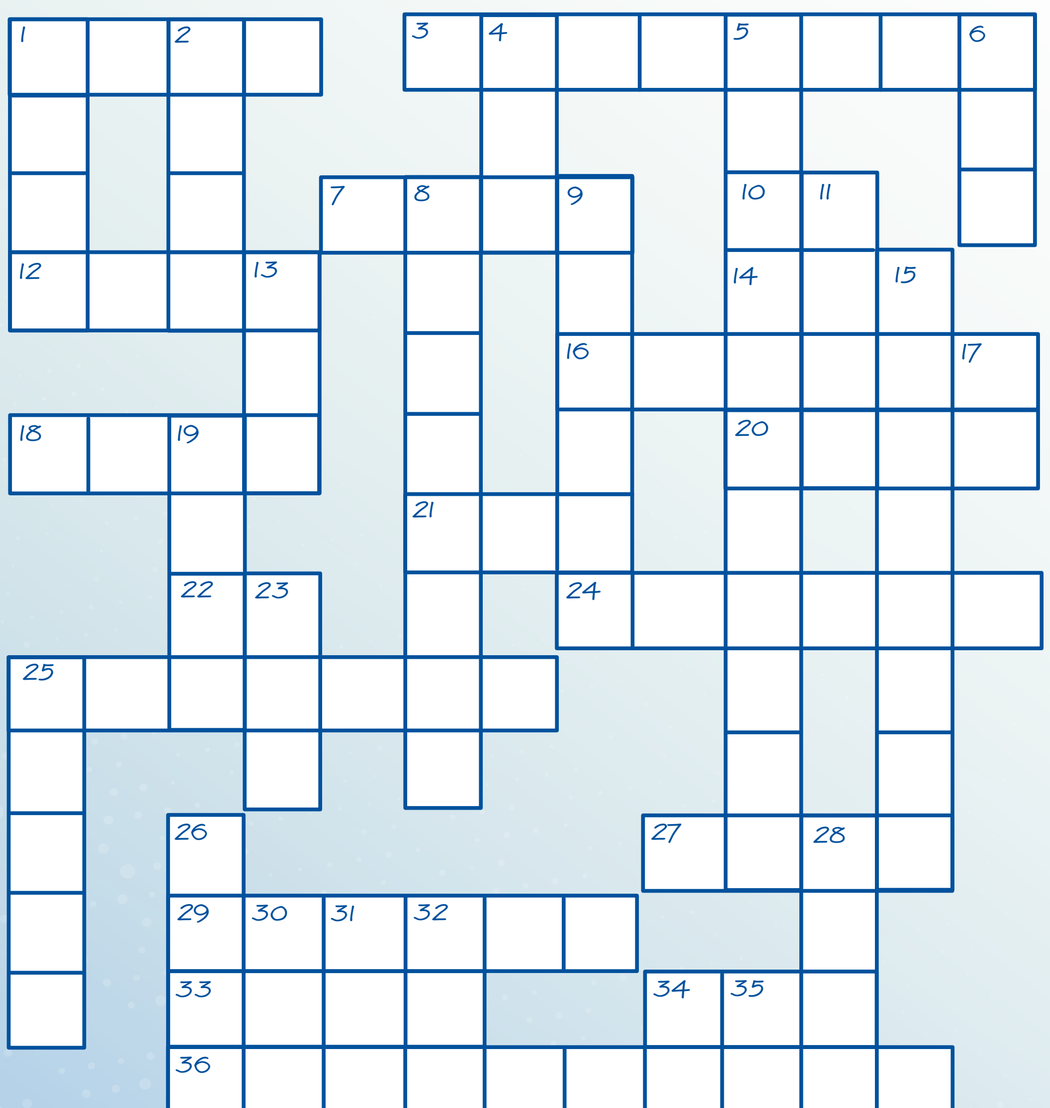
Using the clues, uncover the main concepts of the manufacturing process.

Across

1. World's largest chemical company
3. ________ and minerals
7. Used to power motor vehicles
10. Abbreviation for senior
12. A knot on a tree
14. Female pig
16. Living creature
18. To exist
20. NaCl
21. Farming tool
22. Agricultural group at BASF
24. A chemical ________ and changes
25. Something that helps dissolve
27. Container
29. Sunscreen ingredient
33. Pathway
34. Sick
36. New idea

Down

1. Chairman of BASF
2. Soft drink
4. Frozen water
5. Location of BASF Canada headquarters
6. Bathtub
8. Chemical compound from ISO
9. Person in charge
11. Gypsy
13. Grain
15. Insulation foam
17. Lieutenant (ABBR)
19. Test tube
23. Hard plastic
25. Natural energy
26. German for July
28. Storage tower
30. Truck
31. Hotel
32. Prefix for "new"
34. International technology
35. Lithium



Solution | *See page 38*

BASF **Maze**

Help morpH get to BASF!

Curvy Word **Puzzle**

The letters from 16 words have been curved and hidden in the puzzle. A curved word can start anywhere in the puzzle and can move in any direction. BUT once a word has been used in a square, that word cannot re-use the same square.

ATOM	SCIENTIST
BASF	LIQUID
SALT	PERIODIC
MIXTURE	TABLE
MOLECULE	CHEMICAL
SOLUTION	EXPERIMENT
SOLID	GAS
ELEMENTS	METAL
REACTION	

S	T	U	V	T	A	Q	K	D	I	B	A	R	R	E
I	A	L	O	L	C	C	M	T	C	A	S	D	L	L
V	E	V	I	M	U	X	T	U	R	F	K	R	I	V
M	B	L	A	M	I	M	M	I	E	U	E	U	Q	N
S	R	T	E	L	E	E	E	T	C	I	I	B	N	E
E	U	O	L	S	N	K	O	R	A	L	D	F	C	S
V	A	C	B	K	T	S	O	L	U	R	D	I	E	E
S	D	P	T	L	I	I	D	A	T	A	V	E	N	V
T	B	E	I	O	N	C	N	V	I	D	L	D	E	T
N	R	L	F	D	P	H	S	I	O	B	T	L	U	I
E	O	C	I	F	E	C	R	M	N	N	A	C	N	S
P	S	N	N	R	M	E	P	I	E	S	T	M	E	T
P	S	E	C	I	E	X	M	R	O	F	C	V	L	I
A	E	N	D	A	L	V	E	T	D	I	S	O	K	P
G	F	F	U	F	R	P	T	K	K	B	M	K	Q	P

Solution | *See page 39*

Did you know that chemistry is all around us?

Chemistry is in your garden. It exists in the foods you eat, like bananas — chemistry is even present when you blow a bubble! Through this activity book, BASF hopes to shed some light on how basic, yet complex, the world around us can be, with no shortage of fun along the way.

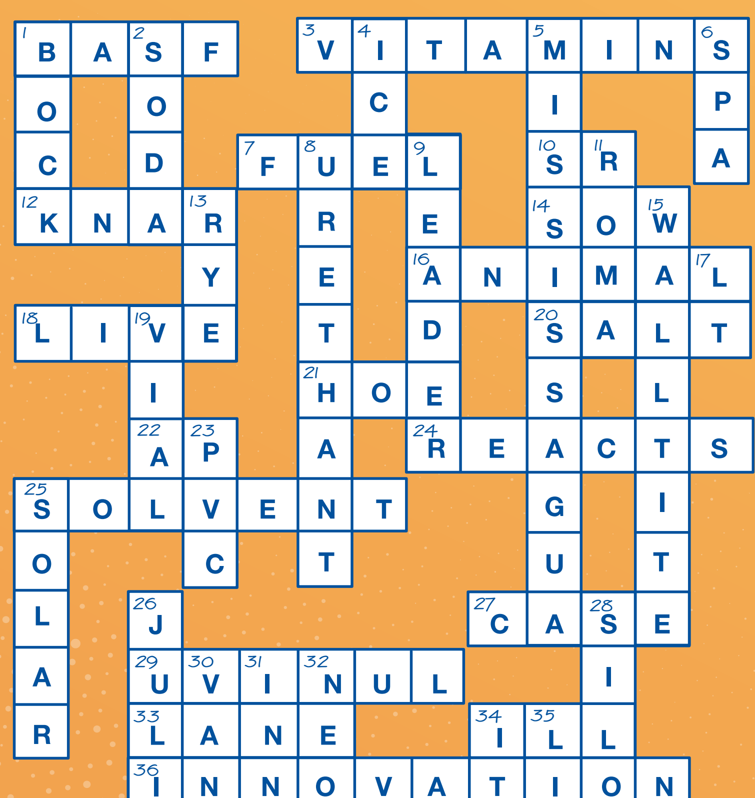
BASF's STEM Education programs support young scientists on their journey to understand the world around us. Knowledge is power, and we hope you use that power to create a sustainable future for all!

Solutions

WORD SEARCH

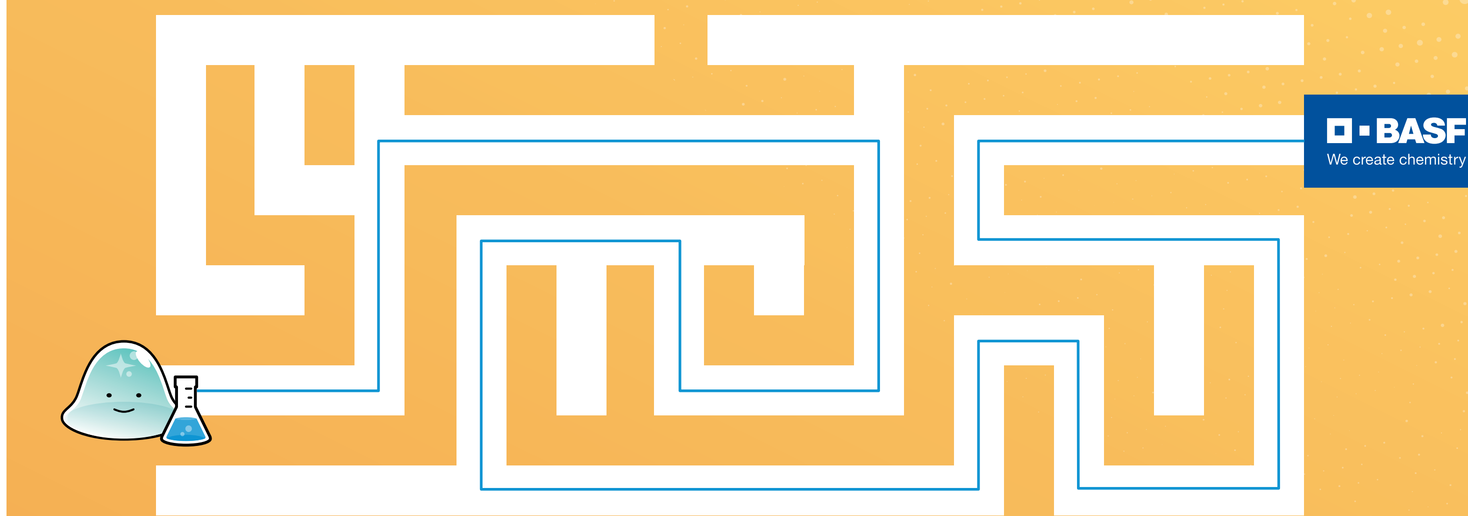
S	M	H	Q	I	E	K	N	N	N	T	U	R	B	M
R	U	I	R	D	M	C	B	O	O	Q	E	J	X	P
E	G	G	R	H	Y	A	T	H	T	K	C	Y	L	E
K	J	H	G	J	Q	P	E	I	A	E	S	G	F	N
R	T	L	J	J	W	K	C	E	P	F	B	O	X	C
A	S	I	M	K	B	C	B	E	R	R	I	O	U	I
M	K	G	G	G	W	A	N	C	P	O	N	W	O	L
M	X	H	R	G	P	B	X	Y	R	T	K	D	P	K
R	O	T	C	A	R	T	O	R	P	A	Y	A	O	L
J	V	E	R	J	M	U	L	A	V	L	Y	K	W	P
S	Y	R	E	O	D	S	P	G	O	U	I	O	J	Z
Z	G	O	G	G	L	E	S	L	M	C	Q	K	N	K
F	Z	J	L	C	R	I	H	I	F	L	F	S	H	S
S	R	O	S	S	I	C	S	A	I	A	D	V	G	V
C	O	L	O	R	E	D	P	E	N	C	I	L	S	N

CROSSWORD PUZZLE



Solutions

BASF MAZE



CURVY WORD PUZZLE

S	T	U	V	T	A	Q	K	D	I	B	A	R	R	E
I	A	L	O	L	C	C	M	T	C	A	S	D	L	L
V	E	V	I	M	U	X	T	U	R	F	K	R	I	V
M	B	L	A	M	I	M	M	I	E	U	E	U	Q	N
S	R	T	E	L	E	E	E	T	C	I	I	B	N	E
E	U	O	L	S	N	K	O	R	A	L	D	F	C	S
V	A	C	B	K	T	S	O	L	U	R	D	I	E	E
S	D	P	T	L	I	I	D	A	T	A	V	E	N	V
T	B	E	I	O	N	C	N	V	I	D	L	D	E	T
N	R	L	F	D	P	H	S	I	O	B	T	L	U	I
E	O	C	I	F	E	C	R	M	N	N	A	C	N	S
P	S	N	N	R	M	E	P	I	E	S	T	M	E	T
P	S	E	C	I	E	X	M	R	O	F	C	V	L	I
A	E	N	D	A	L	V	E	T	D	I	S	O	K	P
G	F	F	U	F	R	P	T	K	K	B	M	K	Q	P

FOLLOW US

BASF Science Education North America

@basf_na

#STEMatBASF

BASF
We create chemistry