Earth Science Reading and Activity Program for Reading Improvement and Engagement with the Earth Sciences

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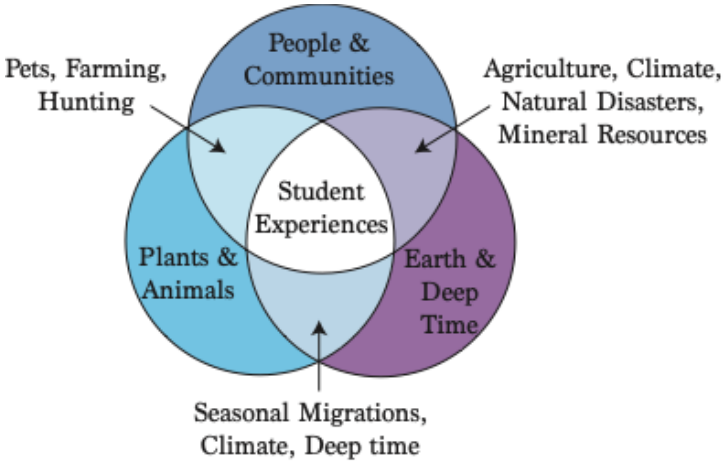
Introduction: The following packet contains a series of book and STEM activity pairings that are targeted at kindergarten to third grade students. The end goal of this suite of lesson plans/activities that we have initiated with the NMT summer program and reading program (Mentoring and Teaching Creates Hope; MATCH program) is to help the reading competency of children, introduce them to Earth science using fun experiments and to build confidence in completing activities. Earth Science isn't a required course for any high school curriculum in New Mexico, so Earth Science departments (and the greater field of geology) generally have a hard time recruiting but it also means that we (Earth Science community) are missing out on a chunk of talent from people that don't know about Earth science (how could they identify Earth Science as a career?). The MATCH program is *centered around victories* and *finding self-esteem through accomplishments*; This series of lesson plan and activities is designed with those two objectives in mind. My intent with these activities is that all the students get to use science as escapism.

Program Layout: For development of this program, I've considered that research on how people learn suggests that they start from their own experiences. I'd like students to exit with some ideas about the Earth (deep purple color), but I think it is too much to expect a student to pick up a book about the Earth. So, I've compiled a suite of possible entry ways to get students to Earth Science that originate from student experiences. For example, if I wanted to get a student to be interested in climate (or even consider it as a theme), I select a reading material that shares overlap between the topic of interest and student experiences (e.g., weather, the seasons, climate), and then shift the activity so it is related to Earth Science (creating a hydrologic cycle in a baggie). The topics in this program are tailored to themes which excite



and interest students. These themes are still being developed as of 7/2/2025 and include:

- Density
- Chemistry of Acid and Bases
- Volcanoes
- Viscosity Tests
- Eruptions
- Rocks and Minerals
- Maps, Orienteering
- Hydrologic Cycle
- Glaciers
- Electricity and Circuits.

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Dedication: This work is dedicated to my two sons, Connor and Carson.

Week 1				
#	Date	Day	Book	Activity
1	6/16	M	Mad Margaret Experiments with the Scientific Method	Density Lab (food coloring, water, vegetable oil,) Materials size, weight comparison, gram scales (rocks cut to similar size but different density; pumice basalt, rhyolite, steel block).
2	6/17	Tu	What Floats/What sinks?	Lava Lamps; glow in the dark; using layers and density to create movement
3	6/18	W	Joe-Joe the Wizard Brews Up Solids, Liquids, and Gases	Red cabbage pH indicator; Oobleck creation
Week 2				
6	6/23	M	Oh, the lavas that flows	Build your Own Volcano (create volcanoes then let them dry) Viscosity races (messy; need materials for ramps)
7	6/24	Tu	Eruption: The story of volcanoes	Paint the volcano; color by number (already made) volcano eruptions after paint dries Large volcano experiment outside?
8	6/25	W	BLING	Growing Sugar Crystals (over weekend) (Set up solutions) Looking at rocks and minerals microscopes Building mineral models
Week 3				
11	6/30	M	How far from home?	Learning about Maps (cut out n/w/s/e symbols and read the map to find key places) Tell a story with a geoboard
12	7/1	Tu	How do birds find their way?	Practice with compass; **Scavenger hunt** using maps of campus and cardinal directions
Week 4				
16	7/7	M	A drop around the world	Build your own water cycle Investigating how rain falls from clouds
17	7/8	Tu	Ice is Nice	Building a river system; Field trip to flume (group 1) Sandbox Ice races (how fast can you melt ice cubes; Timing and comparison); Flubber Glacier Flow / Race
Week 5				
21	7/14	M	The Magic School Bus And The Electric Field Trip	Build a circuit (will be hard) What materials are conductive (which can complete a circuit) Test circuit through salt water, through plastic
22	7/15	Tu	How does my home work?	Circuit x2 adding fans and switches Fruit batteries

Day 1: Scientific Method and Density

Learning Objective:

Part 1: Understand what science is all about (asking questions, testing, failing, repeating)

Part 2: Learn about density (use a scale)

Material Needed:

Introduction

- Book: Mad Margaret Experiments with the Scientific Method
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Density experiment

- Clear plastic cups
- Vegetable oil
- Maple syrup
- Water
- Milk
- Food coloring
- Dish soap
- Rocks cut to size
- Miscellaneous bits (plastic, nuts, washers, pipe cleaners, grapes, gummy bears)
- Scale

Banner

- Banner paper
- Markers
- Colored pencils
- Paint, when time permits

Hook/Intro: Mad Margaret Experiments with the Scientific Method

Lesson Structure:

10 minutes: Welcome and settle

20 minutes: Read book (pair readers, 15 books/ 30 kids, Ms. Maria decide configuration)

15 minutes: Discuss book, Ideas for how science works: Can they remember the scientific method?
Did Margaret ask for help? Did Margaret get it right the first time?
Is finishing an experiment first doing the best? What do you think?
How did Margaret keep track of her observations? A lab notebook!, safety orientation

15 minutes: Find lab notebooks + decorate, make sure they have names, first two pages are table of contents

(2 pm)

20 minutes: Describe what density. Use the bags in image 1 below as an example.

Ask students what the different bags are filled with (what is different).
Ask the students what is the same between the different objects (they take up the same amount of space// they have the same volume).
Have groups of students find the scales (they may need to be assembled) and weigh a bag.
There are six bags, so it could be 4-5 students per bag. They can rotate the bags and weigh each one.
Ask the students which items have the heaviest weights. Which have the lightest? If all the objects have the same volume, which has the highest density?
Students cut out the pictures of the bags with the weights and paste/tape their results into lab notebooks.

25 minutes: We are going to play with liquids with different densities today. Get supplies (see materials for density experiments) students get cups for fluids (instructors/counselors fill up the cups with liquids);
Draw lines on cups and fill up cups so they contain the similar volume of material. Students start by mixing food coloring in water so they have colors in their experiments.
Step 0: Water is in the cup with **two drops of food coloring**
Step 1: Add in the maple syrup
Step 2: Add in the veg oil
Q: What happens to the oil on top of the maple syrup? Does it mix or stay separate?
Step 3: Mix water and a food color in a small cup; pour this into your big cup, go slow
Q: What happens to the water? Does it mix or stay separate? Where did it go?

(2:45 pm)
30 minutes: Snack break
(3:10 pm)
40 minutes: Repeat experiment but go in reverse order.
Let the liquids settle; did they go back to the same order?
Add solids to understand density (tiny beads, pieces of plastic, etc)
Lets try more material. Can everyone go outside and get some leaves/grass and/or find some wood chips/ Go outside and get a few natural materials, sand, grass, woodchips, leaves, rocks, grapes, pumice chips (LW)
Try different colors and combinations.

Make sure to take a picture (LW) and tape it into your lab notebook!
For all objects that you used, make a list of the order of most dense to least dense.
Did all of the rocks float?

(3:50 pm)

45 minutes: *Sinking boats*

Use aluminum foil to craft boats
Between a given team of two people each person should make a boat.
Do the boats float or sink?
Add washers to the boats one by one. Try to make your boat sink.
Work as a team to try and design the best boat.
Make it a competition, teams add washers to their boats one by one to see which boat can support the most weight.
Do a bracket to find a class winner

15 minutes: Clean up (try to save as much material as possible for future experiments; pour vegetable oil and water from all experiments into a common vessel; decant water and pour off maple syrup.

(4:50 pm)

Decorate Density Banner until pick up

Density: How heavy something is for its size

Work with your class to determine the weight of each object to determine their relative densities. Cut out each image with its weight (along the dashed lines) and paste it into your notebook from most to least dense.

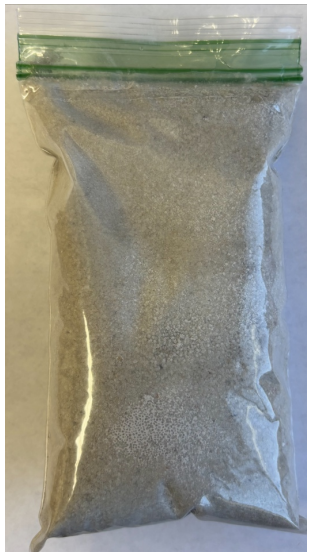
Weight: _____

Weight: _____

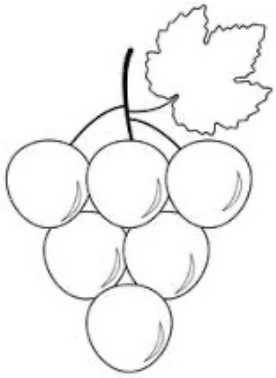
Weight: _____

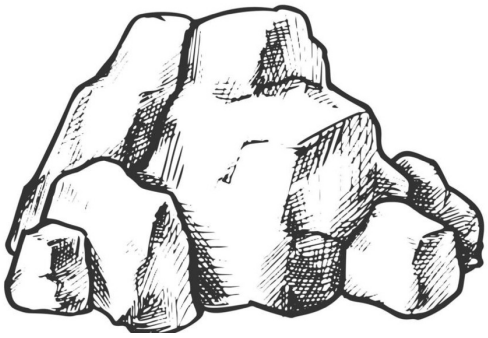
Weight: _____

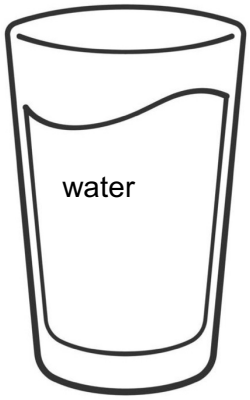
Weight: _____

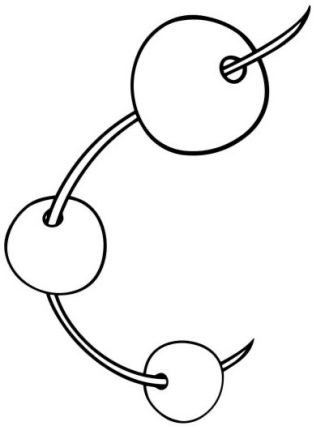


Weight: _____

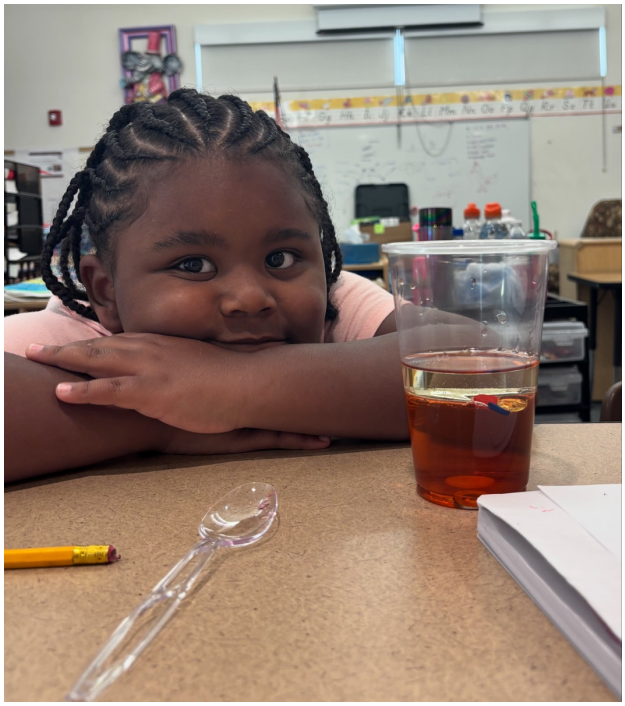








Cut out pictures and paste into your lab notebook in the order of most to least dense!



Student with her density experiment.

Really good density experiment!

Day 2: Density Part 2: Lava Lamps

Learning Objective:
Changes in density lead to movement in materials

Material Needed:

Introduction

- Book: What Floats/What sinks?
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Density experiment

- Clear plastic cups
- 3 oz cups for mixing
- Vegetable oil
- Maple syrup
- Water
- Milk
- Food coloring
- Dish soap
- Rocks cut to size
- Miscellaneous bits (plastic, nuts, washers, pipe cleaners, grapes, gummy bears)
- Plastic forks
- Straws
- Ice

Hook/Intro: What Floats/What sinks?

Lesson Structure:

10 minutes: Welcome and settle

20 minutes: Read book (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)

15 minutes: Discuss book, what is density (learned about it today and yesterday)? Can we change the density of a liquid; what could we do? (add bubbles? Make a layer denser?), safety orientation

15 minutes: Get supplies (see materials for density experiments) students get cups for fluids (instructors/counselors fill up the cups with liquids);
Students start by mixing food coloring in water so they have colors in their experiments.

15 minutes: *Start with Firework activity* (from Science Buddies)
In a three oz cup mix food coloring and vegetable oil (at least two colors)
Fill a clear cup with water
Use the medicine dropper to drop the oil + food coloring mixture into the water. **How does the liquid look after you mix both solutions? Do**

both liquids mix? What happens with the drop when it falls into the water? Does the drop float on top or sink to the bottom of the glass?
Mix the contents of the water glass with a spoon or fork: **Does the solution look different after mixing?**
In a second 3 oz cup, add one tablespoon of water and 10 drops of food coloring
Mix both liquids with a fork

15 minutes: Fill a second clear cup with oil and place it next to the small bowl.
Suck up some of the water-food coloring mixture with the rinsed and cleaned dropper or pipette, and carefully put one drop into the oil.
What happens to the drop this time? Does it float or sink?
Add more of the water-food coloring liquid to the oil drop by drop.
Does the oil change color due to the food coloring? How does the mixture look?
Mix the contents of the oil glass with a spoon or fork.
Set the contents aside at your work space because we will use them later

(2:30 pm)

30 minutes: Snack break

(3:00 pm)

35 minutes: Combine the oil and the colored water so that you have a stratified set of liquids
How could we change the densities of the liquids? Look for ideas (how did we sink the boats?) (Add material to make each layer lighter or heavier)
In a 3oz dixie cup, add ¼ of an alka seltzer tablet to water
Make a hypothesis about what should happen if you add this alka seltzer to the stratified mix: Will it make it through the oil? Will it go through the water? Will it react with the water?
Add the alka seltzer to the mixture, what happens?
In a 3oz dixie cup, try a mix with baking soda + dilute vinegar in a separate container, what happens?
Make a hypothesis about what should happen if you add vinegar and alka seltzer to the mix.
Add some vinegar water to your mix, then add another ¼ of an alka seltzer tablet to water, talk about what happens
Add some salt to the stratified column, what happens (the oil will sink**), can the students think about why this happens?**

Try adding a few more items to the stratified mixture: Can you change the density of a material using a straw (Blow bubbles only, don't enjoy the mixture)? Sugar? Dish soap?

35 minutes: Time to make a lava lamp

- Based on what you've done above, you've tested out different combinations of materials and decide on one combination for the lava lamp
- Drink a bottle of water (need empty bottle and a lid)
- Write your initials on the lid
- Work with counselors and teachers to make glow in the dark water
- remove the end of a highlighter and squeeze out the phosphors); this will become the lava lamp water component
- Add oil to the mix
- Add any other objects you want to your lava lamp
- Test it to see if it glows in the dark
- Don't forget to take a picture for your lab notebook.
- Get to take the lava lamp home
- Close off bottle with masking tape

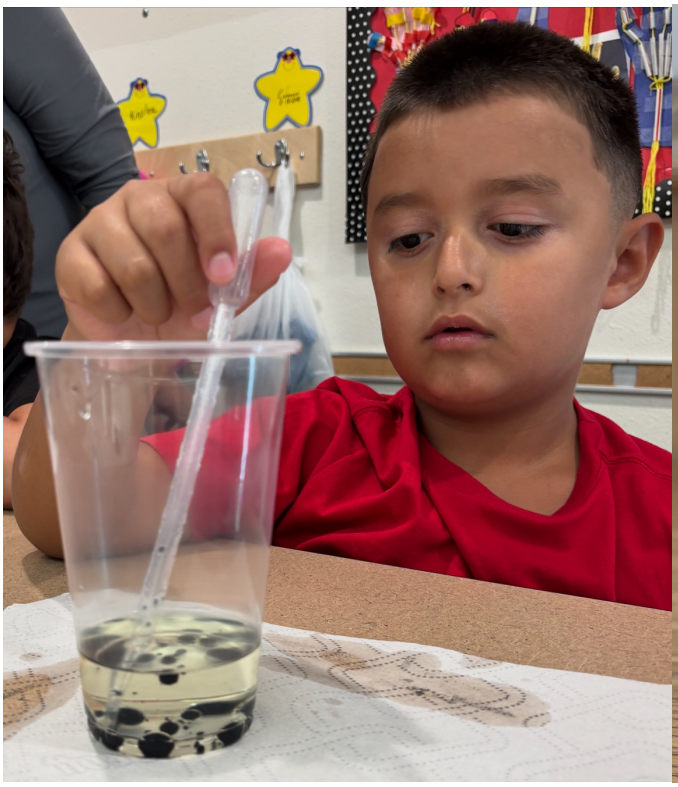
(4:10 pm)

15 minutes: Clean up (try to save as much material as possible for future experiments) (save all cups, LW will clean).

(4:35 pm)

Decorate Density Banner // Play

Fireworks and Lava Lamps



Day 3: Acids, Bases and OOZE

Learning Objective:
Acidity and bases characteristics of materials
Count drops or read the scale on the dropper (1-5 mL)

Material Needed:

Introduction

- Book: Joe-Joe the Wizard Brews Up Solids, Liquids, and Gases
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

pH indicator and oobleck creation

- Clear plastic cups
- Vegetable oil
- Maple syrup
- Water
- Milk
- Food coloring
- Dish soap
- Ketchup
- Straws
- Ice

Hook/Intro: Joe-Joe the Wizard Brews Up Solids, Liquids, and Gases

Lesson Structure:
10 minutes: Welcome and settle, add the date and tape in the activity of the day in your lab notebook
20 minutes: Read book (pair readers, 15 books/ 25 kids)
15 minutes: Discuss book, safety orientation

15 minutes: Get supplies: test tubes, test tube racks, goggles, cups for materials to test, indicator solutions, eye droppers
Only need to fill test tubes up ~1/2 way. The amount of reagent you need to add depends on the concentration of the indicator, which you don't know.
We needed to add ~30 mL of each reagent to get a color change. Because of the age range in this class 5-11, we ended up having to add each reagent one at a time, a as a group. We wait until everyone has their reagent and then we do the drop all at once.
20 minutes: Do some tests using material from density lab: lemon juice, soda, milk, oil, Students record the number of drops for each material before the indicator turns a color

20 minutes: Quick recap (which material needed the most drops to make a change? Which material needed the least drops to make a color change? Can the students select which materials are the most acidic? The most basic? Can they put the materials in an order?
Leave materials on desks for use after snacks.

(2:40 pm)

30 minutes: Snack break

(3:10 pm)

10 minutes: Get some more supplies (more cups, more materials, etc).

25 minutes: Test all kinds of materials in the indicator fluid count drops or measure a mass with the scale
In total there are sixteen different items to test.
Arrange the solutions by pH, Cut out the different items and paste them in order from low pH to high pH in your book. Hint the most acidic thing we will look at is lemon juice/vinegar. Water is neutral.

20 minutes: Make the oobleck

- Get a few bowls and a plastic bag for storage
- 1/4 cup cornstarch for every 50 mL test tube
- mix your favorite color indicator solutions into the cornstarch mixture
- Kneed the mixture and it will form a non-newtonian liquid (ooze)
- Enjoy the ooze
- Save at least one oobleck for the volcano lab
- Don't forget to take a picture for your lab notebook.

15 minutes: Do any of the fluids/oobleks have phosphors? (take turns using six black lights)

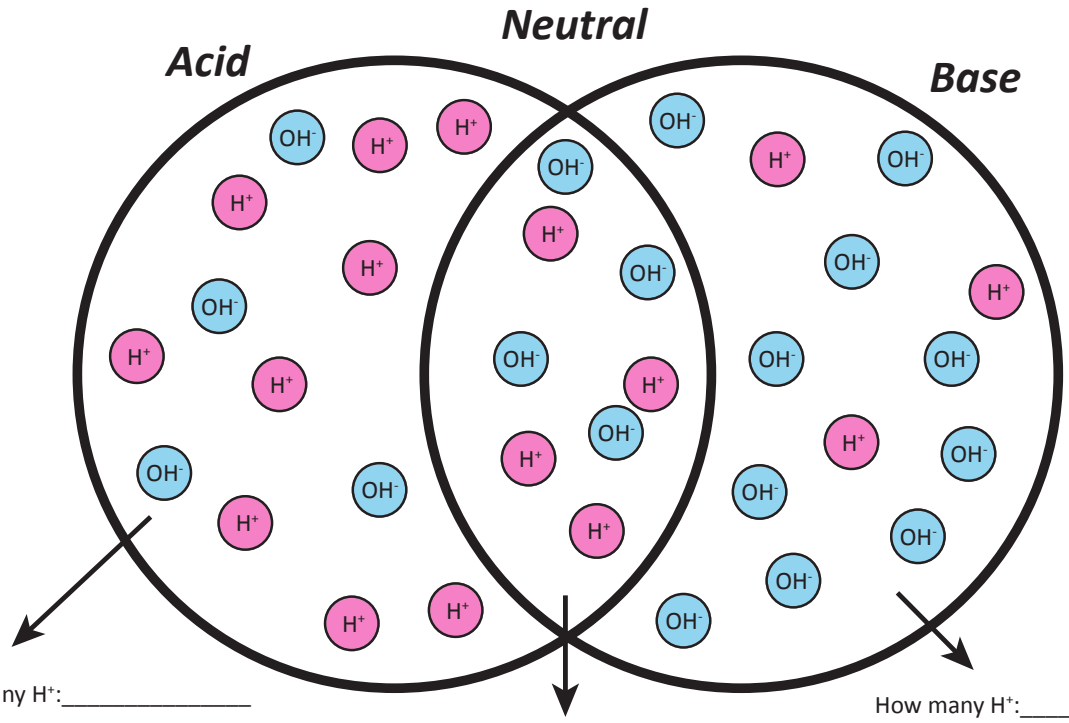
(4:20 pm)

15 minutes:

15 minutes: Clean up (try to save as much material as possible for future experiments.

(4:50 pm)

Decorate Chemistry Banner



How many H^+:_____

How many OH^-:_____

Tastes sour

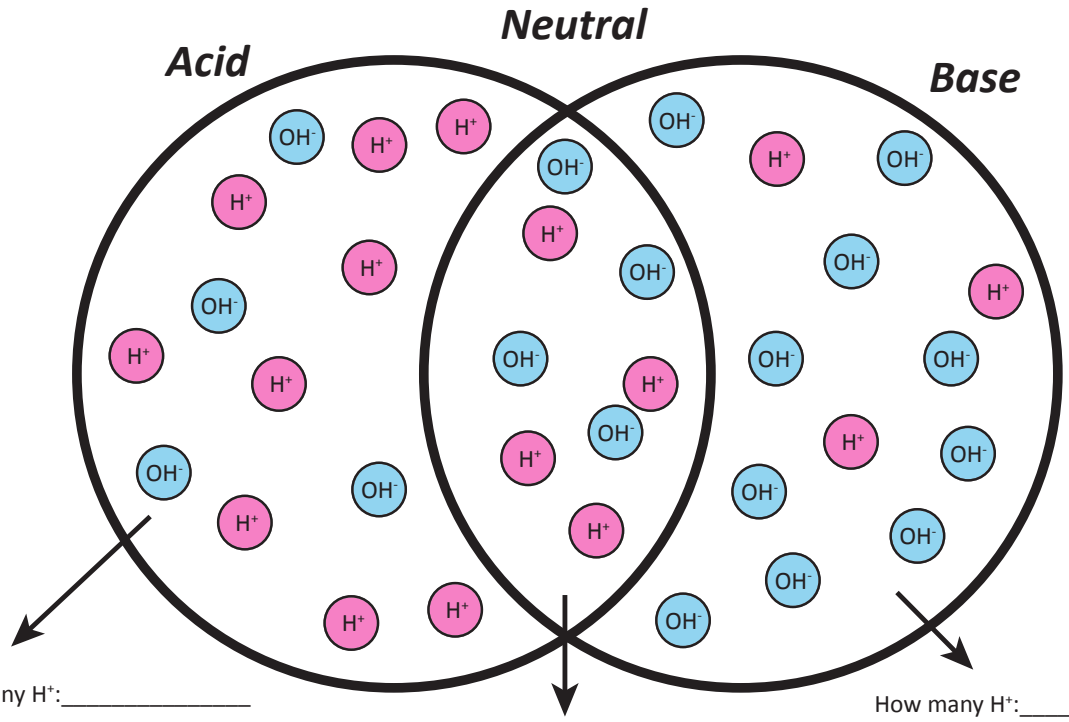
How many H^+:_____

How many OH^-:_____

How many H^+:_____

How many OH^-:_____

Tastes bitter, feels slippery



How many H^+:_____

How many OH^-:_____

Tastes sour

How many H^+:_____

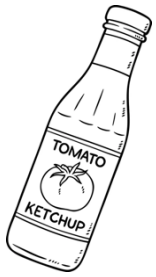
How many OH^-:_____

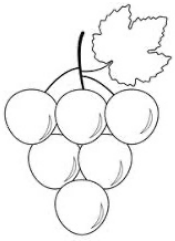
How many H^+:_____

How many OH^-:_____

Tastes bitter, feels slippery

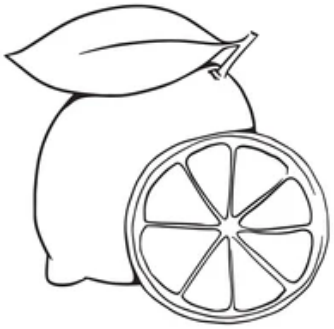
Cut out the tables below and paste them into your lab notebook. Use these to collect your data!

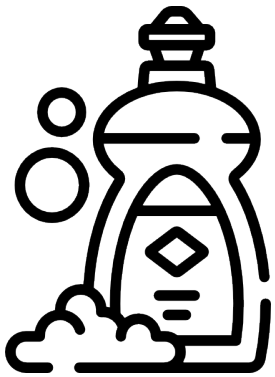
Material	Drops
	
	
	
	

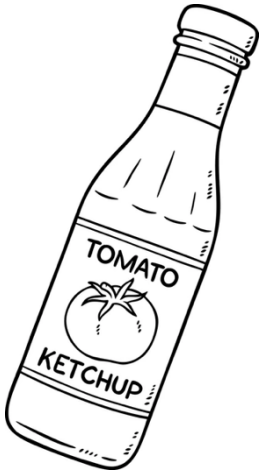
Material	Drops
	
	
	
	

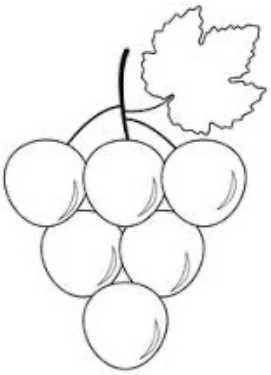
Material	Drops
	
	
	
	

Cut out the pictures below and organize them from most acidic to least acidic.

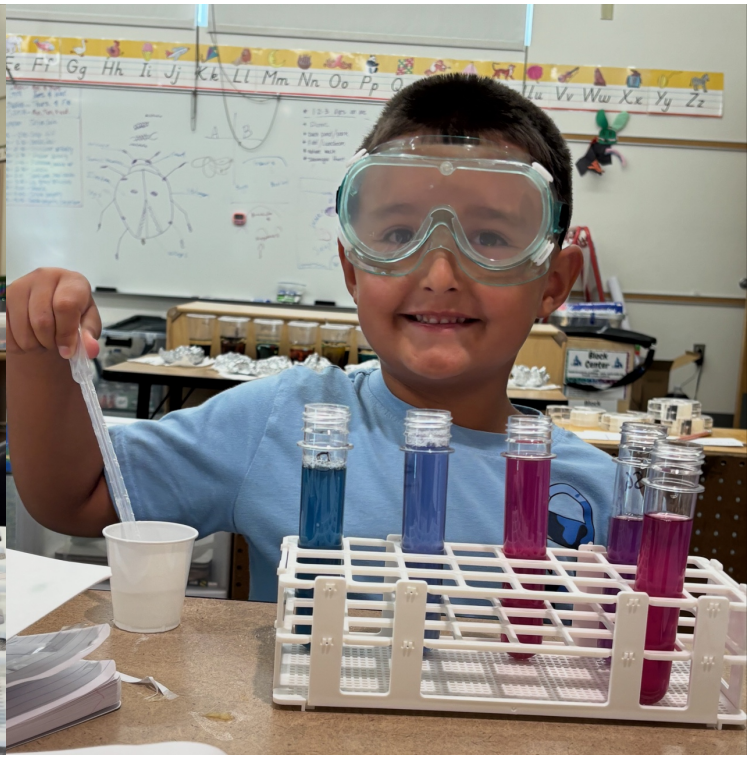








pH Experiments with red cabbage indicator:



Day 4: Lava and Volcanoes

Learning Objective:
Learn about the different types of volcanoes and how volcanoes erupt

Material Needed:

Introduction

- Book: Oh the lava that flows
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Building your volcano

- Film canister
- 10 oz modelling clay
- Wax paper to work on
- Scale

Viscosity tests

- Straws
- 3 oz cups
- Kitchen timers
- Pencils for making start and finish lines
- Need cardboard to make ramps for viscous liquids
- Ooblecks
- Ketchup
- Maple Syrup
- Sand

Prep: Need ramps (I made mine out of cardboard, just flat boards that we will put at an angle). I covered them with wax paper.

Hook/Intro: Oh, the lava that flows

Lesson Structure:

10 minutes: Welcome and settle

20 minutes: Read book

15 minutes: Discuss book, what is density (learned about it today and yesterday)?
Different lavas make different shaped volcanoes: related to the magmas resistance to flow (viscosity)
What kind of materials did we work with last week? Can we think of a material that did not flow easily (oobleck).
We are going to test how materials flow today by making our own magmas.

20 minutes: First we are going to make our own volcanos. Students need to get their own film canisters, 10 oz of clay (need to weigh out on the scale).

Describe what kind of volcano they are going to make e.g., shield, stratovolcano, etc.
Write name on the bottom of the film canister (sharpie, instructor)
Students shape air dry clay into their volcano around the film canister, which will act like a conduit.

5 minutes: Once finished, they need to clean the workspace and get ready for the viscosity tests.
(2:10 pm)
20 minutes: Get supplies: Students (work in pairs) start by making their ramps out of cardboard, taping the wax paper to the board and making their start and finish lines.
Once the ramps are set up, students get cups for fluids, mark cups at similar levels so the same volumes can be used in experiments.
Practice using kitchen timers to see how to start stop and reset
(2:30 pm)
30 minutes: Snack break
(3:00 pm)

15 minutes: Start the experiments. Students need to time the flow from start to stop of the water, ketchup, maple syrup, and the oobleck from last week
(try to clean off wax paper between runs; may need to replace)

Go through each material one by one: start with ketchup, then do ketchup with sand, then do ketchup with bubbles. After you are done with one material move to the next. Mixing materials means that the students have a hard time assessing how adding or changing material impacts the viscosity. We skipped the oil, it would have been too much/messy for 5-11yo.
We also did each test as a group. We wait until everyone has their materials and then do one dump as a group.

20 minutes: Recap; what happened? Can anyone describe which material moved the fastest? Which moved the slowest? Can you all describe the different liquids using the word viscosity?
What about liquids you see every day? (Milk? Cooking oil? Dish soap?) Describe their viscosities.
Think about cat in the hat: Stratovolcano, shield volcano lava dome, cinder cone, which one of these has the highest viscosity? The lowest?

Ask: How might we change the viscosity of the liquids? How did we change the density? (adding bubbles) I'd like you all to try to change the viscosity of your liquids. Adding bubbles with straws… see what happens when you add some sand? Some pebbles? Try changing the viscosity and re-running your tests.

35 minutes: Go back to experiments, help students think about a way to systematically go through adding bubbles, sand and pebbles to each material, then timing their trip down the ramps.

(4:10 pm)

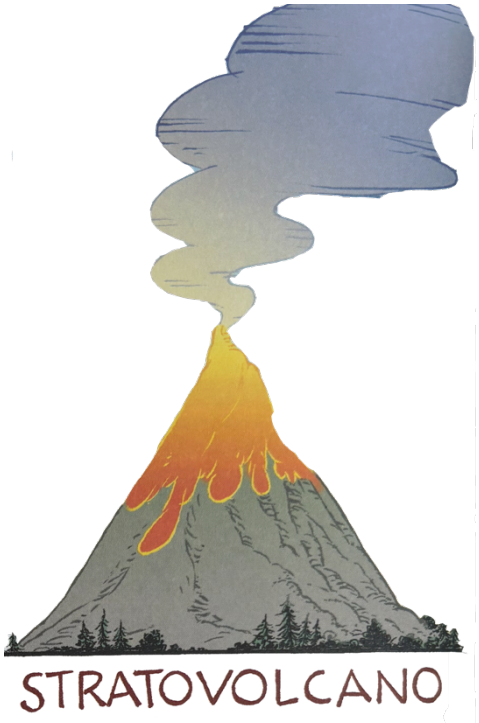
15 minutes: What did we learn? How can viscosity change… Adding bubbles did what? Adding sand? Adding pebbles?
Look at two rocks (which has more crystals?)
If these are made of the same material, which one is going to move faster?

15 minutes: Clean up (try to save as much material as possible for future experiments.)

(4:40)

Remainder: Decorate the Volcano Banner and draw the lab experiments in the notebook

Cut out the images below and paste them in your lab notebook in order of size (biggest to smallest).



Cut and paste the figure below into your lab notebook. Cut out the labels at the bottom of the page. Label each picture (taken by the US Geological Survey) with the appropriate name!

- - - - - - - - - - - - -

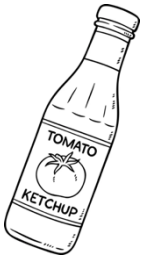
Shield Volcano

Stratovolcano

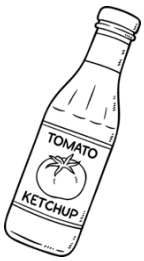
Lava Dome

Cinder Cone

Cut out the table below and use it to record your observations for the liquids, the liquids + bubbles, and the liquids + sand.

Material	Time down ramp
	
	
	
	

Material **+BUBBLES**	Time down ramp
	
	
	
	

Material **+SAND**	Time down ramp
	
	
	
	

Making volcanoes and viscosity tests:

Day 5: Lava and Volcanoes Part 2

Learning Objective:
Learn about the different types of volcanoes and how volcanoes erupt

Material Needed:

Introduction

- Book: Eruption: The story of volcanoes
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Painting your volcano

- Paint brushes and trays
- Small cup of water
- Tempera paint
- Time to dry in sun

Explosion tests

- Alka seltzer
- Mentos
- Baking powder
- Water
- Dilute vinegar
- Carbonated water
- Plastic beads
- Paper plates (with some coating)
- 26 bottles of seltzer
- Mentos
- Dish Soap

Hook/Intro: Eruption: The story of volcanoes

Lesson Structure:
10 minutes: Welcome and settle
20 minutes: Read book (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)

15 minutes: Discuss book, What was left behind when the volcano was done erupting (island)? Volcanoes make brand new land!
Where was the magma stored- does anyone remember what that was called (magma chamber).
We are going to erupt our volcanoes today after we paint and let them dry.

Activity 1: Paint Volcanoes
25 minutes: Get supplies. Instructors dispense paint.
Students need to paint their volcanoes any way they want.
Students then bring them outside

5 minutes: Once finished, they need to clean the workspace and get ready for the eruptions.

(2:15 pm)

30 minutes: Snack break

During snack break try to coat volcanoes with a spray paint sealant

(2:45 pm)

Activity 2: Erupt Volcanoes

10 minutes: Quick overview: We are going to make the volcanoes erupt by inducing chemical reactions. Test each chemical reaction first on your plate anticipate what will happen:

Alka seltzer + H2O+ dish soap;
Dilute vinegar+ dish soap and baking soda;
Club soda + dish soap and mentos

10 minutes: Students test out the three reactions and can make a combination (does alka seltzer react with vinegar? Club soda? etc?)

5 minutes: What did the reaction produce (bubbles!) Was any reaction the fastest/ strongest?
Try loading the conduit of your volcano with one of the sets of ingredients.

(3:10)

35 minutes: Students make eruptions using the materials.
Wait a bit then offer food coloring
Wait a bit then offer small solid bits (plastic, paper, metallic confetti etc)
Encourage permutation.

10 minutes: Recap; what happened? What was the most aggressive reaction?
What happened when you added solids to the mix?
Explain which solids were eruptible
Did anyone get plume?
Gas = acid (vinegar) and base (baking soda) does any one remember acidic foods from the pH lab?

(3:50 pm)

45 minutes: Go outside (mentos and club soda volcanoes);
Stand in a circle Each pair of students gets two bottles

Try to tape paper cups with different sizes and different caldera opening diameters onto the club soda bottles.
Pass out cards (face down) with numbers 2-6 on them (this will be the number of mentos we stick in the club soda)
Go around the circle 2 times, where each pair of students gets to erupt their bottle once each time.
**Ideal to have different bottle shapes!!
Take pictures.

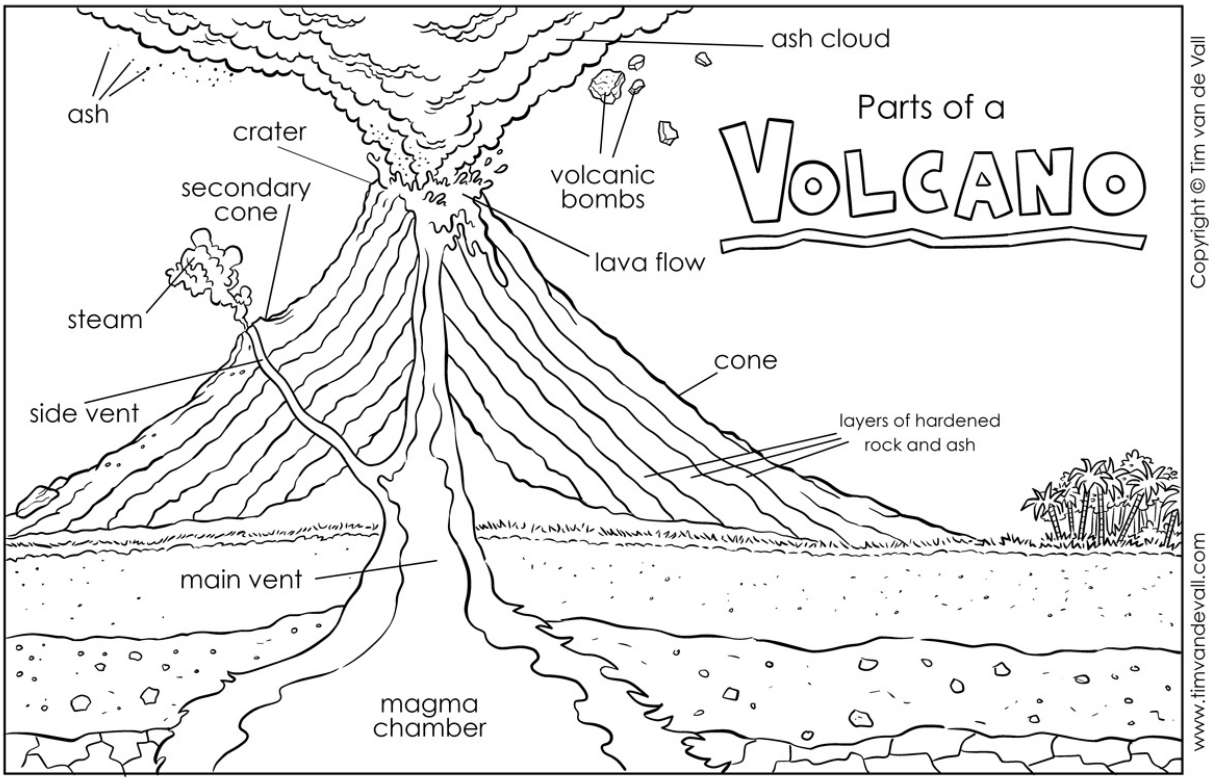
(4:35 pm)

15 minutes: Clean up (try to save as much material as possible for future experiments.)

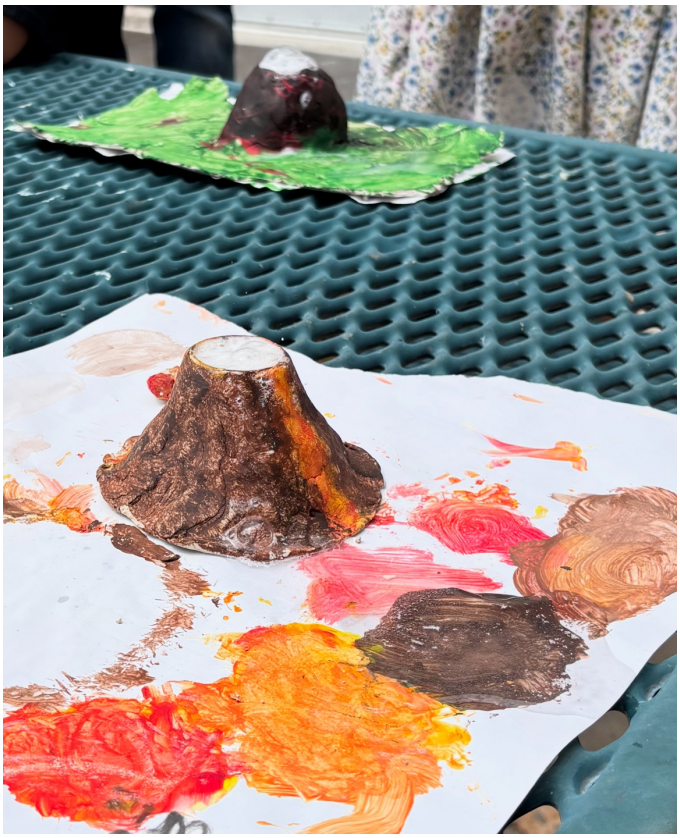
(4:50)

Remainder: Decorate the Volcano Banner and draw the lab experiments in the notebook or color by numbers

Cut out and paste the diagram of a volcano into your lab notebook.



Paint and erupt volcanoes!



Day 6: Minerals, rocks and growing crystals

Learning Objective:
Learn about minerals and how to identify them (first order mineral properties: streak, hardness, cleavage)
Learn about a mineral lattice
Growing crystals

Material Needed:

Introduction

- Book: BLING
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Learning how to test minerals

- Five different minerals (sulfur, talc, calcite, feldspar, hematite variety specularite)
- Streak plates
- Nails
- Pennies
- Hammer (for instructor)

Make a mineral lattice

- 25-30 gum drops for each student
- 1000 tooth picks (14-15 kids went through all the toothpicks

Growing sugar crystals

- Glass jars
- Kettle
- String
- Food coloring
- Sugar (lots)
- Piece of cardboard
- Half a 12” skewer
- scales

Hook/Intro: BLING

Lesson Structure:
10 minutes: Welcome and settle

20 minutes: Read book BLING, about rocks and minerals (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)

60 minutes: Discuss book and how someone identifies a mineral

Learn how to test minerals one by one go through the mineral properties described by the book.
Start with streak test, then do hardness
Pass out the minerals 1 by 1, followed by streak test.
Students may not streak their minerals until everyone has one.
Recommend doing a countdown (3, 2, 1 streak)- the students really enjoyed this.
Shout out results. Go through 5 minerals
(took approx. 20 min)

Next pass out the hardness testing tools (glass plate, copper penny and nail). Again, one-by-one go through each mineral and complete the hardness test.

Finally, take a large mineral and ask the students what will happen if they break the mineral (will it turn into a powder or will it make nice sides? Show hands)
Break mineral (calcite in this case, show the students the nice fresh cleavage planes).
Note: very short attention span for this last property, though the shock value was good.

2:30 Snack break

3:00 Making a Candy mineral lattice
First show the student examples of a lattice. I brought mineral lattices from our Mineralogy collection
Then show the students one or two examples of how to use gum drops to make a lattice
In reusable cups, give each student 25-30 gum drops
Dump tooth picks in the middle of table so students can take as they need.
Students create a lattice to their liking.
Activity lasted about 45 minutes.

Skipped: ***Growing crystals (will grow over the next two days and weekends)***
This should be largely set up (counselors get the boiling water)
Students need to cut string, tie string from ½ 12” skewer,
Place skewer over cardboard and test it so that the
Students weigh and add in the sugar (carefully)

Counselor pours sugar mix into glass
Students add dye
Students mix the solution then hang their string

Decorate Rocks and Minerals Banner

Gum Drop Mineral Lattices:

“Hold up your lattices so everyone can see!”

Day 7: Learning about Maps

Learning Objective:
Learn how to interpret colors on a map
Learn about cardinal directions
Tell your own story with maps and directions by constructing a geoboard
https://education.nationalgeographic.org/resource/mapping-the-classroom/

Material Needed:

Introduction

- Book: How far from home
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Map reading

- Large world maps
- Questions from packet (included in pages following this plan)
- Pictures for coloring (included in pages following this plan)
- Colored pencils, Crayons

Making a Geoboard

- 22" x 17" (semi posters, two 11x17 sheets) map of town (Socorro in our case) with modifications (pictures of garbage trucks, star noting the present location, etc.) that are mounted (taped) to cardboard (I raided the office recycling).
- Tacks
- Colored string (make sure to have lots of pink)
- A silly story that takes students through the town

Practice with Compass

- Enough compasses for each student

Lesson Structure:

10 minutes: Welcome and settle

15 minutes: Read book How far from home (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)
Ask the students what animals they like as you go, so they engage a bit with the book
Following the book explain that we are going to see how far away these animals actually are from where we are.

60 minutes First, we are going to color the different animals we read about in the book and then we are going to cut these out with scissors. *This takes about 1 hour, depending on how efficient the students are. They were slower than I expected because they were chatting and happily coloring.*

While the students are coloring tape some of the laminated world maps to the floor.

30 minutes: When the students finish as them to work in pairs, two per map, to place the animals on the map. Start by having them describe the different colors on the map (oceans, land, mountains, etc).
Have the students identify where they live (USA, then New Mexico). Have them place the home star on NM.

Ask the students about cardinal directions, explain that North is almost always at the top of the map and that South is opposite North. Explain East is to the right and West is to the left. Have the students set out the letters N, S, W, E as you talk.

Then, move on the different animals. Go through animal by animal and have the students look at the map (e.g., Monarch Butterfly = Mexico, the snakes from How far from home migrate through Illinois, etc.)

Finally, as them to place a star on their maps to see where they would go on vacation if they could? Go through one by one and have the students look at where the other students would go on vacation *(for us, a lot of students said Hawaii, but others said countries in Europe, and one said they wanted to go to Egypt; Frankly, I was delighted that no one said Disney).*

2:55 pm Snack

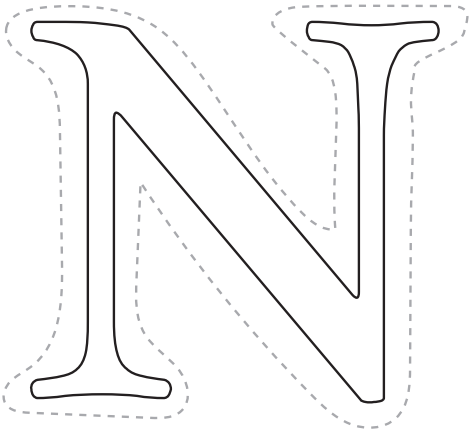
30 minutes: Use a geoboard
Pass out the geoboards, walk around and let students select the color string they want to use. Choosing the right color is a big deal.
Place a handful of tacks on the table for the students to use when they mark their locations.
Have the students tie a knot in the very end of their string; Use a tack for the students to push into the knot to mark their starting location.

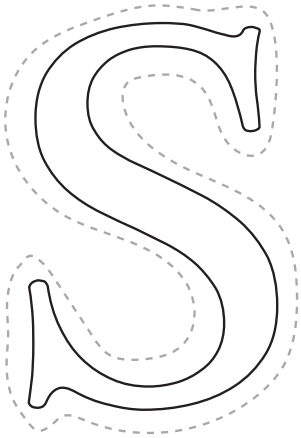
Read the silly story about a day in Socorro and get the students to use the string and tacks to mark locations.
At the end the crazy path will appear on their boards (examples are shown after the lesson plan).

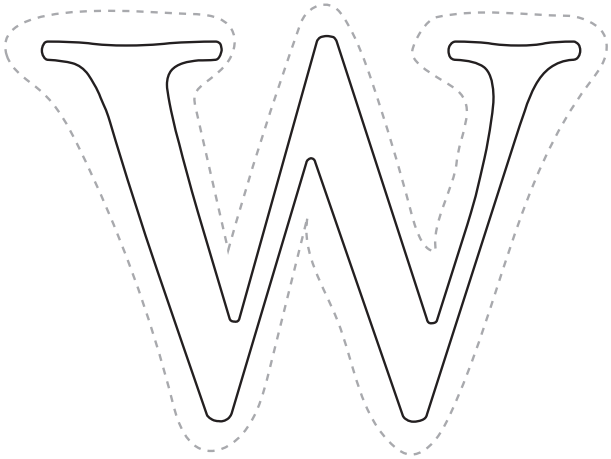
3:50 pm

15 minutes Practice using compasses.
Pass out a compass for each student
Go outside and show them how to always find North; If they can find North they can get around.

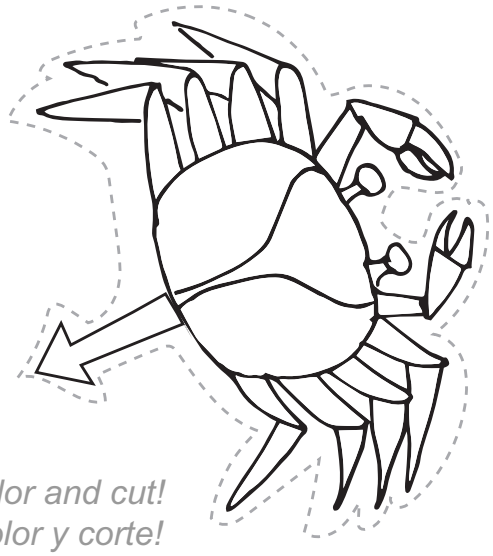
We played a crazy game to use the compasses. I had them find North, then run to the North (call stop after 3 seconds).
I then asked them to spin, then stop once they were all mixed up.
I then asked them to run East using the compass (3 seconds then stop)
Spin, new direction, repeat…
They loved it.



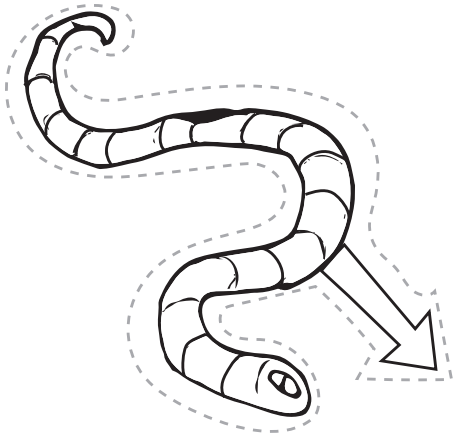


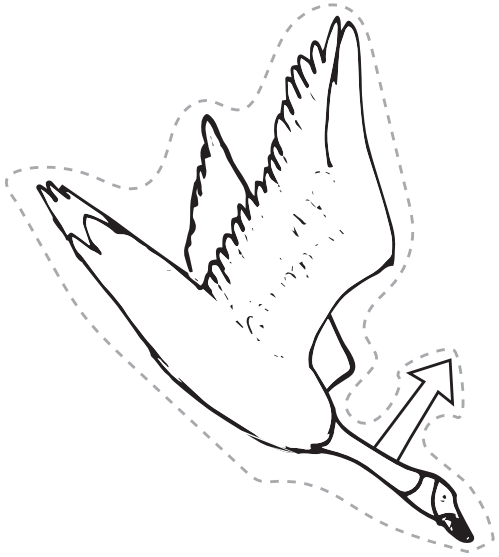


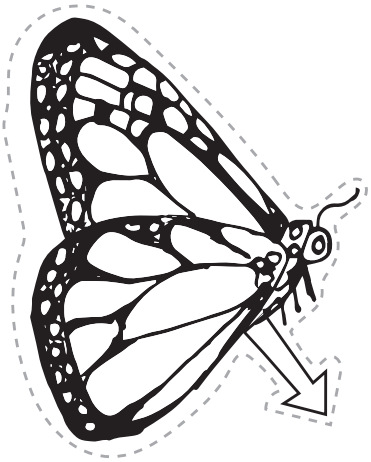
color and cut!
icolor y corte!

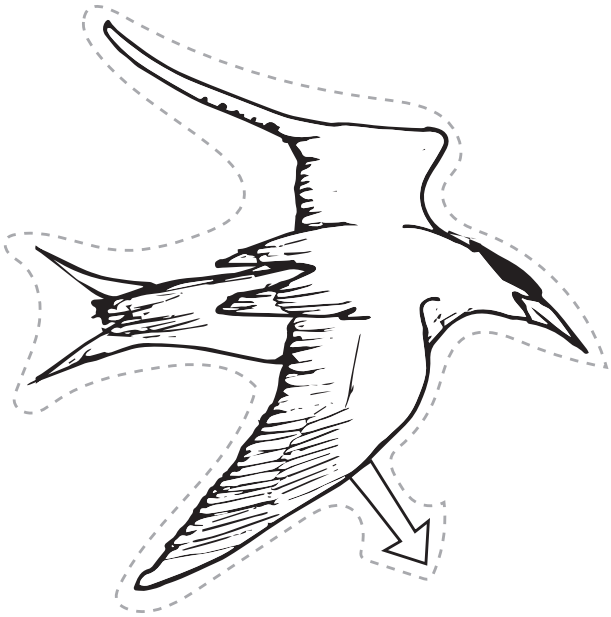


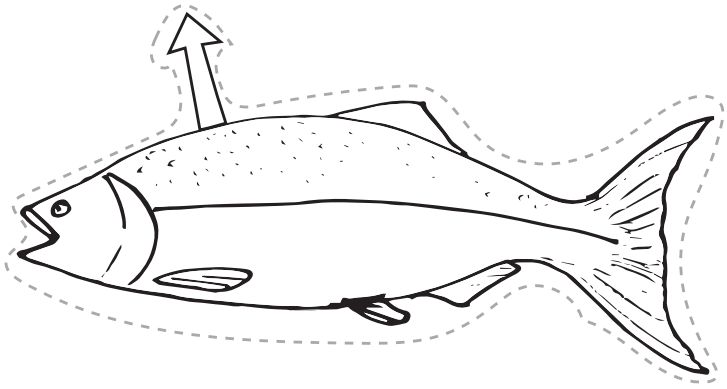
color and cut!
icolor y corte!











<u>Part 3</u>: Thinking about maps and directions

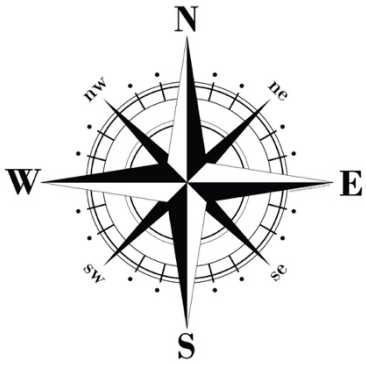
3.1 Let's make some observations about the map.

What color are the oceans? _____

The landmasses (areas above the ocean) are lots of colors, can you name a few colors?

_____ _____ _____

3.2 The picture to the right is a **compass rose**, it tells the four cardinal directions on a map. These directions are used to describe where places are relative to one another.



- N is North
- E is East
- W is West
- S is South

Label your map with your cardinal directions. Hint: **North** will be at the **top** of the map.

3.3 Try it out! Practice map reading! Can you find the United States of America? How about New Mexico?

What state is **west** of New Mexico? _____

Which ocean is **east** of the United States of America? _____

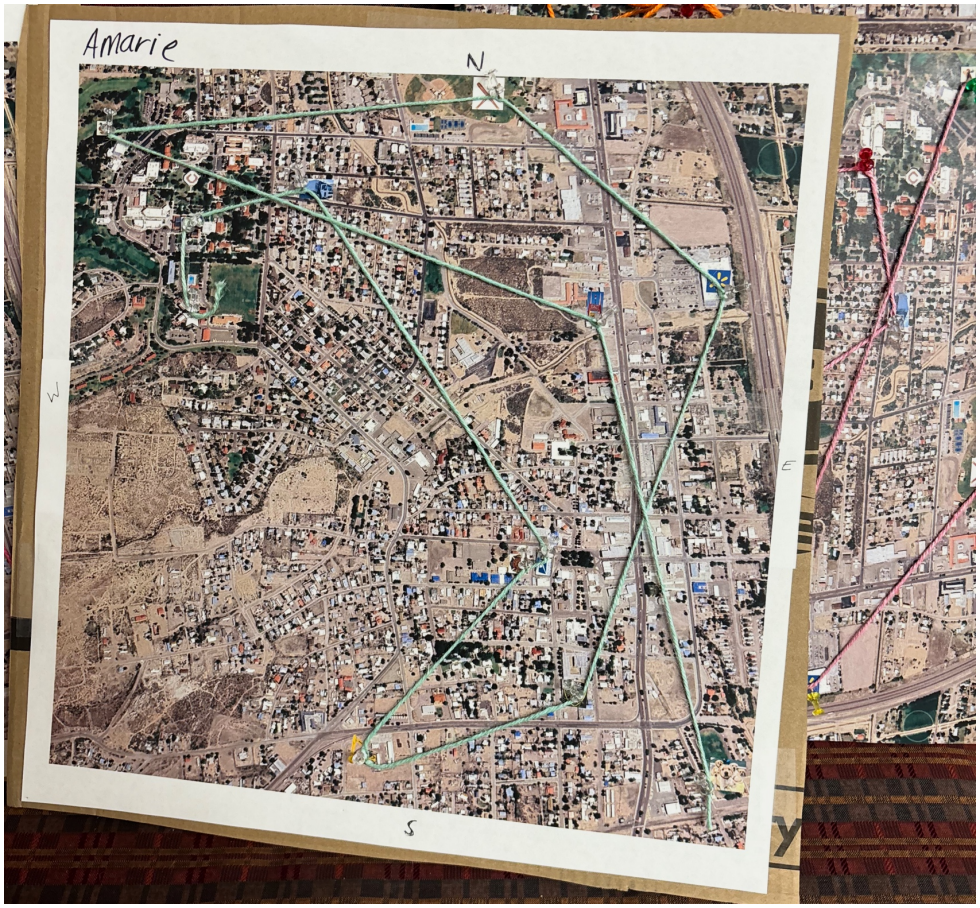
Which country is **north** of the United States of America? _____

Can you find Australia? (Hint: Australia is on the southeast side of the map.)

Which country is **southeast** of Australia? _____

Colorado is _____ of New Mexico.

Ask a question to a friend about a direction!
On your map, find Albuquerque in New Mexico. Socorro is a little south of Albuquerque. Place the star labeled **Home** on the map so the arrow points to Socorro (approximately).


Amarie
N
W
E
S

Day 8: Practice with Compass and scavenger hunt

Learning Objective:
Learn how to use a compass to solve a scavenger hunt
Work with cardinal directions

Material Needed:

Introduction

- Book: How do birds find their way?

Scavenger hunt

- Water
- Compass
- Good attitude

Practice again with the compasses before they go.

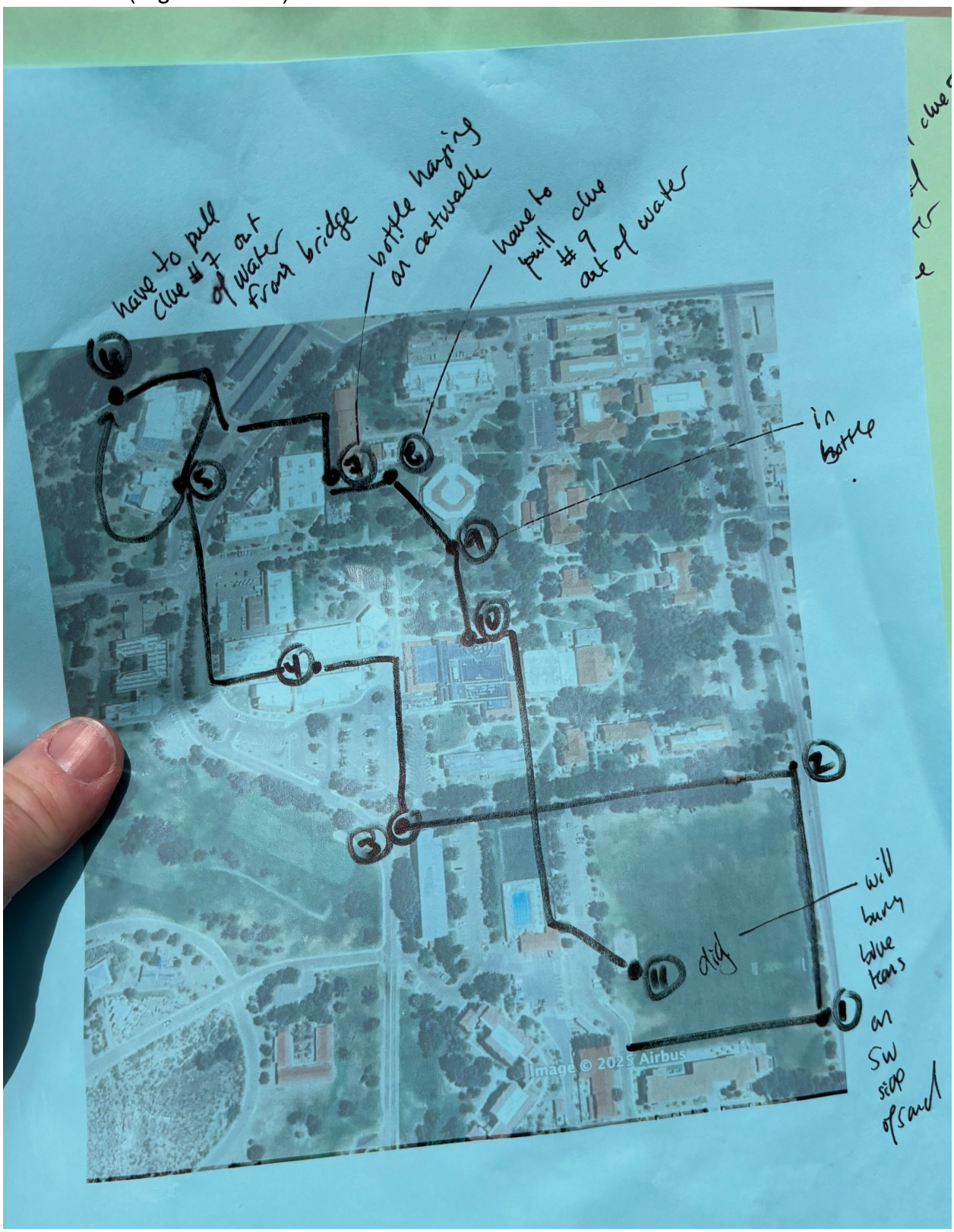
Recommend dividing into groups of 4-5.

We had a class of 11 students this day. We made two groups consisting of older and younger kids. I created two 11 stop scavenger hunts, where students could only find clues using the cardinal directions (and hints). The goal was to find treasure. I buried two boxes of gems and candy in a sand volleyball court. I hid clues in water bottles and suspended them from trees, I put clues in bottles and sunk them in ponds. I hung clues from cat walks on campus.

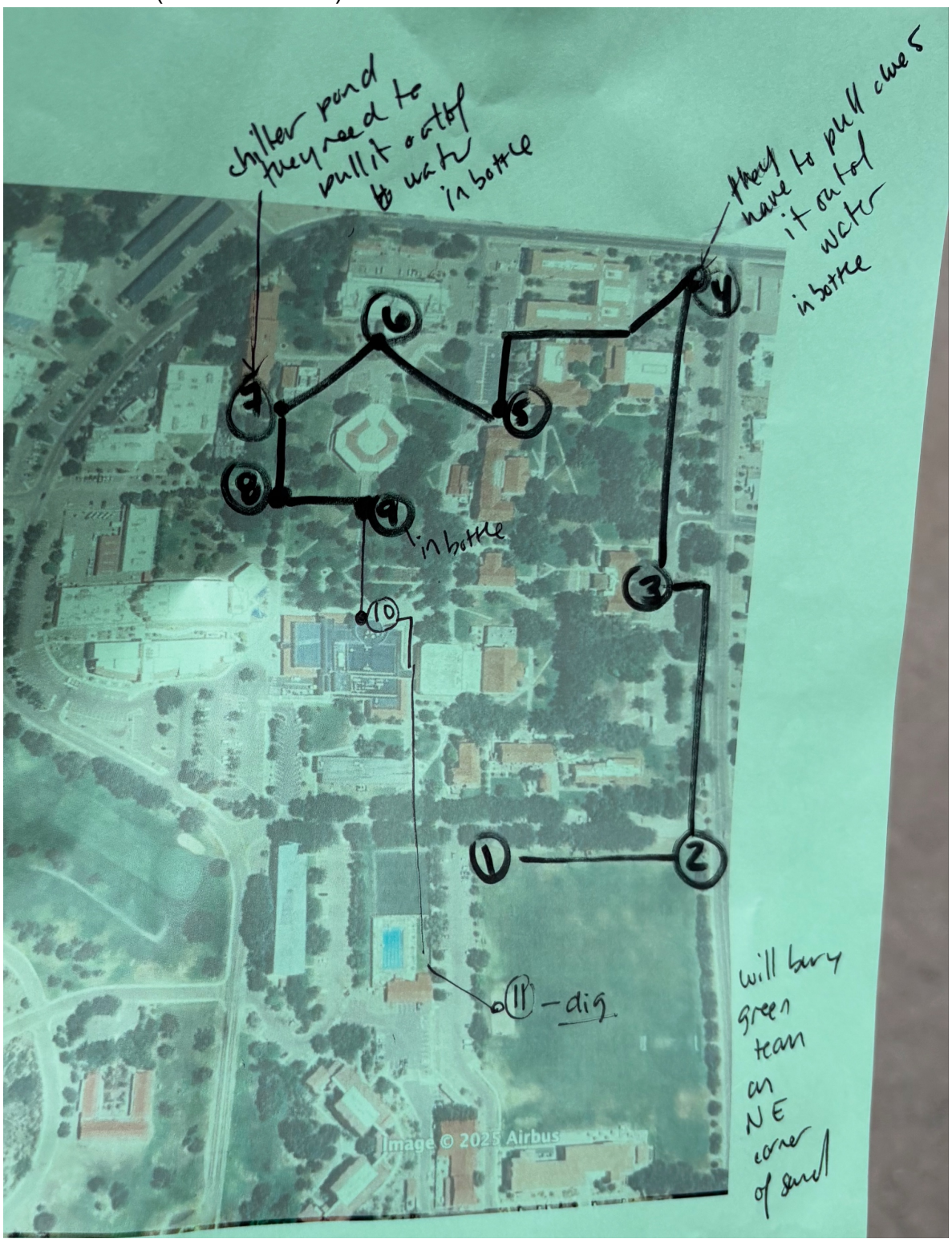
Students were very excited. The younger kids were very tired at stop 8, they mostly used their compasses. They fought over who got to find the clue, pull the clue out of the bottle. It was essential to have an order of who gets to do what. Taking turns was not easy with so much excitement.

This was a lot of work to set up, but they really had fun, were outside, and maybe learned something about a compass.

Blue Team (Big Kid Team)



Green Team (Little Kid Team)



Day 9: Water Cycle

Learning Outcomes

Understand the Water cycle
Describe how clouds are formed.
Understand what causes rain to fall from clouds
Understand the different bodies of water on our Earth

Introduction

- Book: Drop of water
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Make your own water cycle (modified from Svenja Lohner, PhD, Science Buddies)

- Resealable plastic bags (2)
- Permanent marker
- Water
- Liquid measuring cup
- Spoon
- Strong tape, like duct tape
- Blue food coloring
- Area that gets lots of sun and another that gets very little sun during the day
- Sand or dirt
- Larger pieces of rock that will fit in the bag, at least 2

Rain falling from clouds

- Drinking glasses
- Access to a sink and/or source of water
- Shaving cream
- Food colouring
- Pipettes

Examining maps for bodies of water and modeling bodies of water Part 1:

- Map of Socorro
- Access to a sink and/or source of water
- Aluminum foil pans
- Aluminum pan or another shallow dish
- Sand
- Pebbles
- Water
- Water jug
- Cup or bottle with a narrow opening
- Aluminum foil
- Paper towels

Lesson Structure:

10 minutes: Welcome and settle
20 minutes: Read book (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)
15 minutes: Discuss book “A Drop Around the World”

Activity 1: Make your own water cycle

5 minutes: Get supplies

25 minutes: Flatten both plastic bags and decorate your bags with some elements of the water cycle (water, clouds, sun, etc.) with the permanent marker. Be careful not to poke a hole in the bags with the marker.

- Add one drop of food coloring to about 1/3 cup of water.
- Add 2 tablespoons (Tbsp.) of the colored water into each plastic bag.
- Keep the bags upright so as not to spill any water.
- Add 2-3 Tbsp. of sand to one side of each of the plastic bags. Part of the sand should be submerged, and part of the sand should be above the water level.
- If you have larger pieces of rock, add one each to the other side of the plastic bags. Again, part of the rock should be above the water level.
- Carefully close both plastic bags and make sure they are fully sealed. Make sure to keep the bags upright so as not to spill any of their contents.
- Find a sunny place, like a window that is in the sun for a large part of the day, and tape one of the bags upright to the window or to another object. Use enough tape to keep the bag in place for at least one day.
- Tape the second bag to a window or in a place that gets very little sun. Again, secure the bag well enough that it stays in place
- Observe both bags over the course of the day. Check them every 1-2 hours. On days where the Sun is hidden behind clouds it might take longer for you to observe anything happening in the bags.
- Once you have made your observations, think about how this could explain where the rain comes from.

10 minutes: Recap: What do you notice happening over time in both plastic bags? What happens to the water? How does the water move inside your bags? How do your results differ between the bag in the shade and the bag in the sun? Can you explain your observations?
What processes did you observe in your model that were similar to rain? Where did that water come from?
What water cycle processes can you observe inside the bags?
How does what you observe mimic the water cycle we see on Earth?

(2:25)

30 minutes: Snack break

(2:55)

Activity 2: Creating the ‘cloud’

5 minutes: Get supplies

25 minutes: Spray enough shaving foam so that there is a good covering on top of the water and at the top of the glass.

- Try and make the shaving foam look like a cloud!
- If the food colouring does not come with a pipette, then a separate one will need to be sourced. The food colouring needs to be added as gently as possible – dripping works, but pressurised squirting may cause the colouring to pierce the shaving foam cloud and enter the water directly.
- The 'cloud' should 'fill up', followed by the food colouring falling into the water, just like rain falling from a real cloud! Use brightly coloured food colouring for a really clear and interesting visual effect!

5-10 minutes: Recap:

Explain to the learners that clouds form when water vapour rises into the air. When this vapour comes into contact with cold air, water droplets are formed and they then link together to create clouds.

Eventually the clouds become so full of water that they cannot hold it anymore, and so the water falls back to the ground – this is rain.

(3:30)

<u>Activity 3: Looking at maps of water bodies and modelling them</u>

20 minutes: Look at partial map of Socorro; On your maps write N, E, W, S

Can anyone find where we are?

Easy question: What color is the water on the map? Can anyone tell me what the blue area is on the map (what is its name and what is that geographical arrangement of water called.

Work with your partner to find: A river, a stream, a pond.

5 minutes: Quick recap? Where did you find a river, stream pond.

What is the name of the river? Lets make a model for it.

Ask: What is special about this water body?

Ask: What are the shores of this water body like?

Ask: How much water is in this water body? Is it big or small?

35 minutes: Get supplies to make a watershed.

- Create a mini socorro and river
- Explain to students that they will build their model inside the pan.
- Provide each group with the materials they will need and point out how some of the materials can be used; for example, show how aluminum foil

can be folded to make a riverbed. Alternatively, you can have one central table with all the materials where students can go to and get what they need for their model.

- Ask each group to first discuss how they want to build their water body before they start building. Encourage them to think about the following questions:
- Once students have an idea of how to build their model, have them start building their water bodies inside the aluminum pan. Advise them to first finish building the landscape with dry materials before adding the water to the pan, and to use the aluminum foil to contain the water if possible (this applies mainly to the groups that build a lake or river).
- Note: It is recommended to just give one cup of water to each group in order to limit water spills. Tell students that they can ask for more if they need more.
- Give each group 15 minutes to finish their model. Make sure students divide tasks such as pouring water, handling the different materials, or cleaning up, within their group.
- At the end, have students bring all river models to a central location. Add initials to pan.
- Have one or two groups explain their model (revisit important vocabulary words like channel and flow)
- Going to work on more model watersheds tomorrow. But need to save these river models so we can compare between

10 minutes

Day 10: Water on Earth, Topography and Glaciers

Learning Outcomes

Understand how a glacier formed and where glaciers are located on Earth (and why)
Understand how a glacier moves
Visit the AR sandbox and the Flume to see topography in action

Introduction

- Book: Ice is nice
- Lab Notebooks
- Pens, Pencils
- Scissors
- Tape

Glacier Race (Modified from Stevespangler.com)

- Elmer's Glue-All (gallon size)
- Borax (a powdered soap found in the grocery store)
- Empty plastic soda bottle with cap
- Large mixing bowl
- Plastic cup (8-ounce size)
- Spoon
- Cookie sheet or plastic tray
- Measuring cup
- Food coloring
- Water
- Paper towel
- Zipper-lock bag
- Half a poster tube for the glacier run

Lesson Structure:

10 minutes: Welcome and settle
20 minutes: Read book (pair readers, 15 books/ 25 kids, Ms. Maria decide configuration)
15 minutes: Discuss book "Ice is Nice"

Activity 1: Make your glaciers

60 minutes

- Fill the empty bottle half full with warm water and shake (okay, put the lid on first and then shake). Pour the glue-water mixture into the mixing bowl and use the spoon to mix well.
- Measure ½ cup (120 mL) of warm water into the plastic cup and add a heaping teaspoon of Borax powder to the water. Stir the solution. Don't worry if all of the powder dissolves.
- While stirring the glue in the mixing bowl, slowly add a little of the Borax solution you just made. Immediately you'll feel the long strands of

molecules start to connect. It's time to abandon the spoon and use your hands to do the serious mixing. Keep adding the Borax solution to the glue mixture (don't stop mixing) until the GAK has a putty-like consistency. You should be able to roll it on the table like dough, but if you let it rest for a couple of minutes, the GAK will spread itself out. Set this batch of white GAK off to the side while you mix up the next batch.

- Repeat the four preceding steps to make your second batch of GAK, but this time add about ten drops of blue food coloring during Step 2. As you're adding the Borax solution, try to keep the consistency of this batch the same as that of the one you previously made.
- I recommend having the white GAK premade so the students can mix it easily
- Here comes the fun part of combining the blue and white batches of GAK. There's no right or wrong way to do this—just twist and fold the large pieces until you get a cool swirl of blue and white GAK.
- Lay the GAK out on a cookie sheet or plastic tray. Use a few books to prop up one end of the cookie sheet. This will allow the GAK to begin to flow slowly downhill. The mixture of blue and white GAK creates some amazing patterns as the mixture flows downward, simulating the slow movement of a glacier.

Assessing the relative speeds of a glacier:

- Work with the students to line up poster tubes cut in half in the long direction (so that they have one long chute.
- Students should place the glacier gak in the poster tubes, followed by a line of tooth picks (tooth picks go across the GAK, short distance). Recommend they work in teams.
- Once the students have their gak in the tube, they should pick it up. Do it as a group. Everyone loads, everyone gets their toothpicks on the gak and everyone lifts at the same time
- What part of the glacier moved faster?
- Students should take turns, now the other students set their gak in and try it.

Conduct a glacier race

- Have the students use the timer and see how fast their glacier takes to get down the tube. Try having a glacier race bracket and find a winner.

Snack break

Walk to MSEC to do some activities with the flume and the AR Sandbox.