Name _____ Date _____ Period _____

Crosscutting Concepts Stations Activity

Science is a part of our daily lives. Walking through the hallways, chewing and swallowing food at lunch, and using your phone to send text messages all involve science! It is important that you develop science skills and understand important concepts by making connections to big ideas in science. One way this can be achieved is by viewing what you are learning about through one or more of the 7 "lenses" called **Crosscutting Concepts (CCCs)**. It will take some time, but these lenses are designed to help you understand how and why things work in the natural world. This is an introductory activity to the CCCs which will help you identify them in future lessons.

The CCCs are:

- Patterns
- Cause and Effect
- Scale, Proportion and Quantity
- Systems and System Models
- Energy and Matter
- Structure and function
- Stability and Change

Directions: You will be rotating through 7 lab stations that will expose you to the CCCs. The goal is that you will start to recognize them in the everyday science experiences you will have in this class. Be sure to follow along with the teacher's directions for how you will be completing the activity. Read the provided information about the CCC before answering any questions!

Station 1. Patterns

Patterns are everywhere in nature. From the phases of the moon to the shapes of flowers, patterns can be observed in many places. Humans are very good at identifying patterns!

1. What does the word "pattern" mean to you?

2. Name any patterns you see in the 4 snowflakes.

3. If you were to place the 4 snowflakes into only 2 groups, how would you classify (group) them and why?

4. Can you think of any other patterns in nature? Name them.

Station 2. Cause and Effect

Cause and effect is a relationship you are probably very familiar with. If you stay up too late, you are typically very tired in the morning. The lack of sleep caused the effect of you being tired. The cause is why it happened and the effect is what happened. There are endless examples of cause and effect in the natural world and sometimes there is more than one cause. This CCC can be used to predict and explain events which are sometimes simple and sometimes very complex. When you view science through this lens, you can better identify relationships and attempt to explain why something happened.

1. A baseball player swings the bat. The baseball bat hits the ball into the outfield. Name the cause and name the effect.

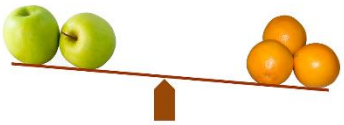
2. Experiment: Place the index card on top of the cup. Place the coin on top of the index card. Very quickly and carefully, flick the index card and observe what happens. Write the cause and effect.

3. If you left ice cream out in the sun, what would happen? Why? Identify the cause and the effect.

4. In the boxes below, draw a new example of a cause and effect relationship that involves water.

Cause	Effect

Station 3. Scale, Proportion, and Quantity



Have you ever played the game "Twenty Questions" to try to guess an object that someone is thinking of? Maybe you have asked a question like, "Is it bigger than a car?" in order to first try to figure out the size of the object. This CCC is related to not only size, but a comparison to other things. You will notice many types of measurements are used when learning science. Look at the image above. The two apples have just about as much mass as the three oranges. The proportion is 2:3 as you may have learned in math which helps you compare them accurately.

1. Put the marble in your hand. If the earth were the size of the marble, Jupiter would be the size of a watermelon and the sun would be the size of a dinner table! This is called a scale model. Write what you think a scale model is.

2. If you made Jupiter the size of a marble, how would that change the size of the earth? Sun?

3. Draw a scale model of the following objects in the blank space below: car, mouse, human

Station 4. Systems and System Models

This Crosscutting Concept is used to identify a single system and its boundaries (limits). Because many aspects of science are connected, it is important to single out one system and its parts but still recognize where the boundaries are. For example, if you were studying the system of ice melting, the parts would only include the ice, heat source (where heat is coming from), and/or the substance the ice is on/in.

1. Experiment: Pick up the ball. Drop the ball on the floor from shoulder height. Pick up the piece of paper. Drop the paper on the floor from should height. Name the parts of the system.

2. Name something that is NOT part of the system.

3. Think about the system in number one. Why is it important to name "air" as part of the system? Think about how dropping the paper had a different outcome than dropping the ball.

4. Draw and label the system from number one and include all of the parts.

Station 5. Energy and Matter

The flow of energy and matter in and out of a system can often be tracked. It is helpful to know what goes in (input) and what comes out (output) because it restricts or limits what a system can do. For example, you may be familiar with how plants make food in a process called photosynthesis. Energy from the sun combines with carbon dioxide and water to form oxygen and glucose, the plant's food.

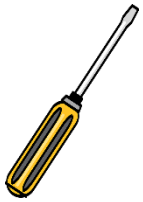
1. Look at all of the pictures: a leaf, a drop or water, oxygen molecule, carbon dioxide molecule, the sun, glucose, 3 "input" arrows, and 2 "output arrows". Arrange them on the table to show the transfer of energy and matter in photosynthesis. Look back to the paragraph for help. Draw how you assembled the pictures below!

2. Where is the energy for photosynthesis coming from?

3. If there are lowered amounts of input going into a system, what do you predict could happen to the output? Use an example from photosynthesis in your explanation and refer back to number one for help!

Station 6. Structure and Function

The shape of something affects its function. In other words, how something is shaped in nature affects what it can do! Furthermore, the material the structure is made of can have an effect on its function.



1. Observe the screw. Which screwdriver (1 or 2) should be used to twist the screw into the wood? How do you know?

2. Get a piece of tape and tape your thumb to your hand. Try writing with a pencil. Explain what happened and why.

3. Observe the birds' beaks and answer the questions.

Bird	Image
Eagle	
Hummingbird	
Spoonbill	

a. Which bird has a beak more suitable for scooping up fish? Explain.

b. Which bird has a beak more suitable for ripping meat? Explain.

*Move on to the next page!

c. Which bird has a beak more suitable for sipping nectar from flowers? Explain.

d. How does having a sharp, pointed beak limit what foods a bird can eat?

Station 7. Stability and Change

The word "stability" has the root word "stable" which generally means unchanging. The stability of a system may have minor changes that do not affect how it functions over time. It can also have major changes that are consistent and predictable making it stable overall such as the changing from night to day. This is called equilibrium. Notice the word "equal" in equilibrium. Some things change and some stay the same. Sometimes there are big and small changes that can affect a system. It's important to understand stability and change because it can have a significant effect on a system.

1. Observe the image of the Burmese Python. In the Florida Everglades, this animal is considered an invasive species, an organism introduced to an area that causes harm. They do not belong in the Everglades and are disrupting the ecosystem.

a. Name one way the Burmese Python can harm the ecosystem.

b. Make a prediction of what could happen in twenty years if the Burmese Python has no natural predator and continues to reproduce.

c. Name one solution to the problem of the Burmese Pythons in the Everglades.

Name _____ Date _____ Period _____

Crosscutting Concepts CCCs Review:

Directions: Match each example with the correct crosscutting concept. Write the letter on the line.

1. _____ Cause and Effect

2. _____ Systems and System Models

3. _____ Structure and Function

4. _____ Patterns

5. _____ Energy and Matter

6. _____ Stability and Change

7. _____ Scale, Proportion, and Quantity

a. Observing the repeating moon phases

b. Animals have various shaped hands for specific uses.

c. Poke an inflated balloon with a needle and it pops

d. Energy from the sun turns water to water vapor

e. Your circulatory system pumps blood throughout your body and includes blood, blood vessels, and your heart.

f. Our global climate has been changing and temperatures have been increasing over time.

g. If Earth's history were divided into 24 hours, humans arrived in the final second.

For the teacher:

If you're looking for a rich, quality activity to introduce students to the NGSS Crosscutting Concepts, then this is the perfect lab resource for you! **Students rotate through 7 stations to become familiarized with the CCCs in which they experience what the concept is and how it applies to science**. Real world examples are included at each station to make them explicit and meaningful. Some stations require short student experiments while others involve making observations and drawing conclusions. This LOW PREP resource (see materials list below, most is included) is crucial in exposing students to these "lenses" at the beginning of the year so that they may recognize them throughout their learning experiences and deepen understanding. If you're new to the NGSS, this activity will even help YOU understand them better! Options for extension activities and trendy labels to print and display the CCCs on a bulletin board are also included! No prior knowledge of the CCCs or of the topics of the stations is required! *As stated in the framework, students should not be assessed on their ability to define the crosscutting concepts in isolation. Rather, students should start to see connections from the crosscutting concepts to what they are learning about. This is the value of exposing students to the CCCs at the beginning of the school year. Recommended time is about 7-8 minutes per station and then time to review as a class. It generally takes two class periods.

Stations Overview:

1. Patterns in snowflakes

2. Cause and Effect in Newton's 3rd Law (students flick index cards off cups)

3. Scale, Proportion, and Quantity using our Solar System

4. Systems and System Models of dropping a ball versus a sheet of paper

5. Energy and Matter in Photosynthesis

6. Structure and Function of screwdrivers, thumbs, and birds' beaks

7. Stability and Change in the Florida Everglades (Burmese Python introduction)

Included in this resource:

- Student lab sheets
- CCCs Review
- "For the Teacher" Section with tips
- Trendy Labels of CCCs to print and on a bulletin board
- Materials List with some included materials (images)
- Ideas for Extensions
- Answer Keys
- Philosophy on why introducing the CCCs are necessary
- Quality examples and images at each station

- Links to more info on the CCCs and FREE graphic organizers

Why is this important? We as science teachers understand that science is a part of our daily lives. It is our job to help student develop science skills and understand important concepts by making connections to big ideas in science and linking old and new knowledge. This activity exposes students to the seven Crosscutting Concepts in lab stations so that they are can start to develop the mental tools necessary for understanding science. It provides a great introduction that students can refer back to throughout the school year.

The Crosscutting Concepts are one of the three main dimensions of the NGSS that science educators should be designing learning experiences around. They bring together the core ideas of science engineering. When we make the Crosscutting Concepts explicit throughout students' learning experiences, it deeps their understanding of the natural world and helps develop a science-based view of the world. It's no wonder that the term "lenses" has been thrown around for the CCCs. To help students make these connections, we will use the term "lenses" throughout the stations as an introduction. The CCC are "patterns", "cause and effect", "scale, proportion and quantity", "systems and system models", "energy and matter", "structure and function", and "stability and change".

You can explore more about the Crosscutting Concepts in Appendix G of the Next Generation Science Standards at this link: Appendix G - Crosscutting Concepts.

If you're looking for a similar activity to introduce students to the Science and Engineering Practices, check out this one: Science and Engineering Practices Stations Activity. (If you plan to use both resources, it's best that you offer some time in between because it may be overwhelming for students.)

If you're looking for full page copies of all 3 dimensions of the NGSS to use as your objectives, you can find them here: NGSS Objective Board Labels. Making your daily objectives clear without giving away anything is very important! It's a method that I use in my classroom: Defining Daily Learning Goals

Extension ideas:

If you're looking for a way to extend this lesson, there are a few options below. It is important that the Crosscutting Concepts are made visible and integrated into lessons to make them more explicit for students. Here is a link to FREE CCCs graphic organizers: CCCs Graphic Organizers

- **Scavenger hunt:** Have students go on a Scavenger Hunt to find other examples of the CCCs in their daily lives or at school.
- **Poster Project:** Assign each student or group of students a different CCC to create a poster on to display in the classroom.

Follow my store at this link to stay up-to-date on my latest NGSS resources! Click here!

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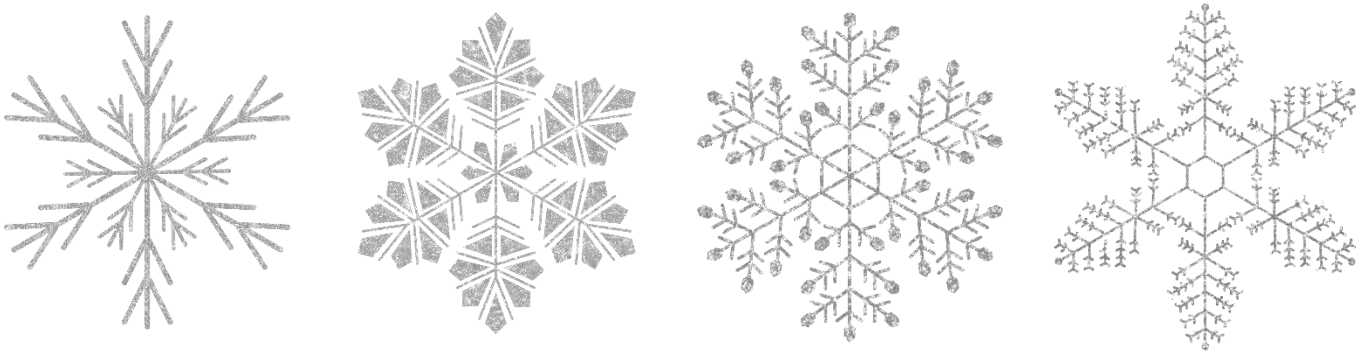
Looking for ways to assess student understanding of the NGSS on tests, pre-assessments, exit tickets, etc.? Then, check out my newest line of NGSS Assessment Questions here: NGSS Assessments and Task Questions

Materials:

Station 1 – Cut out each snowflake and place on a tray or plate.



Station 2 – cup, index card, coin

Station 3 – marble

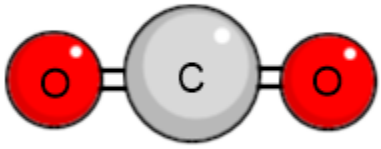
Station 4 – any small ball (tennis ball, bouncy ball, etc.), sheet of paper

Station 5 – Cut out each item.

Sun

Leaf

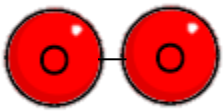
Carbon Dioxide (CO_2)

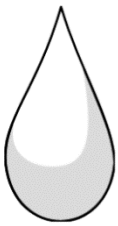


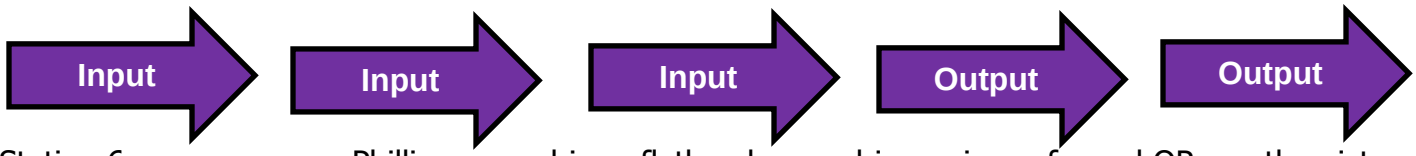
Water

Glucose

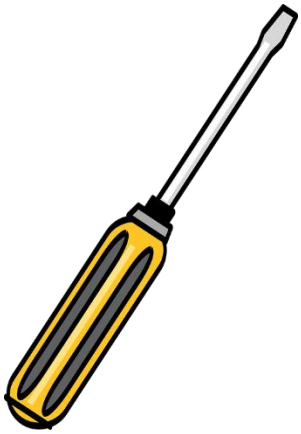
Oxygen







Station 6 – one screw, a Phillips screwdriver, flathead screwdriver, piece of wood OR use the pictures below. You will need tape for taping thumbs.



Screwdriver 1

Screwdriver 2

Station 7 – Cut out the image below.

Answer Key:

Station 1

1. Answers may vary but should be along the lines of "something repeated."

2. Answers may vary but examples are: symmetry, 6 stems, similar branches, etc.

3. Answers may vary.

4. Answers may vary but examples are heartbeats, behavior, periodic table of elements, waves, rocks, etc.

Station 2

1. There may be a few variations of this answer but generally: Cause: A baseball player swings the bat. Effect: The baseball bat hits the ball into the outfield. Students may say the cause is the bat hits the ball and the effect is the ball goes into the outfield. Both are considered correct for this activity.

2. Again, there may be a few variations but generally: Cause: Finger flicked the card off the cup. Effect: Coin fell into the cup.

3. Same here. Cause: Left ice cream in the sun. Effect: Sun melted the ice cream.

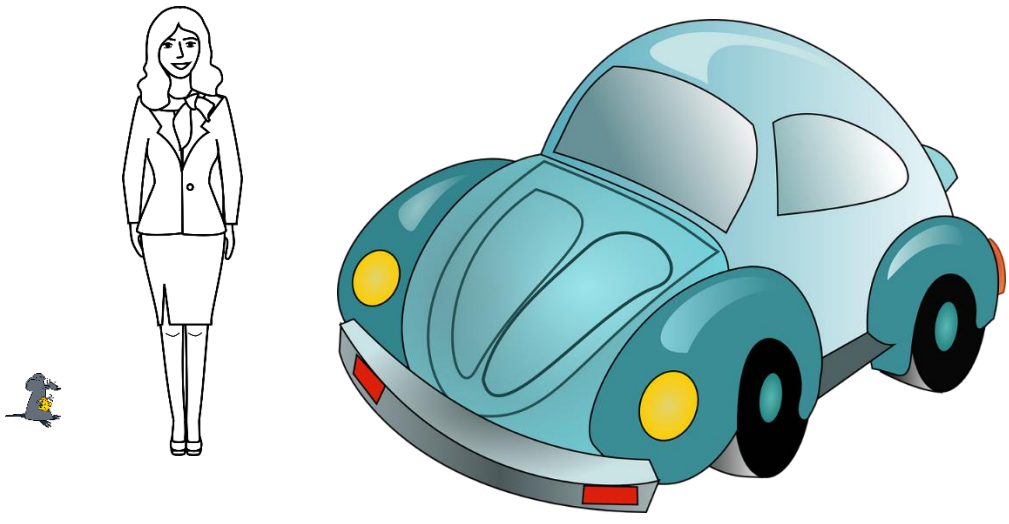
4. Answers may vary. Example - Cause: Water was put into the freezer. Effect: Water froze.

Station 3

1. Answers may vary, but based on the reading students should have a general understanding that a scale model is a model that is made when you accurately compare one object's size (or other feature) to another.

2. If you made Jupiter the size of a marble, that would make both the sun and earth smaller because you are changing the scale to be smaller (from watermelon to a marble).

3. The students' drawings should be similar to these differences in sizes:



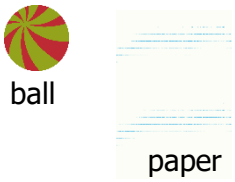
Station 4

1. You, ball, paper, ground, air

2. Answers may vary but examples are a pencil, water, door, etc. anything not involved in the experiment!

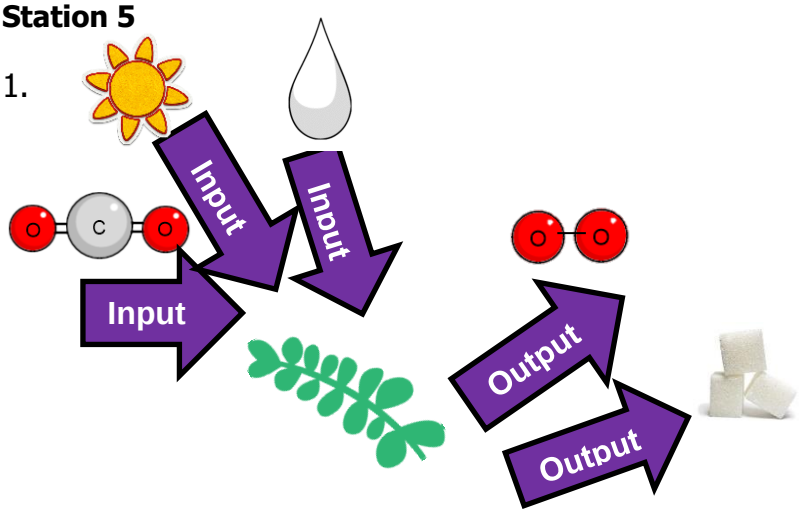
3. Air is important because it touches both objects and affects how fast the objects fall (air resistance).

4. Students' drawings should generally look like this:



Station 5

1.



2. Sun

3. Students may predict lowered input makes lowered output. A student example using photosynthesis would be less sunlight means less glucose during photosynthesis.

Station 6

1. (It depends on which screwdrivers you use as the teacher.) If you use the provided images, screwdriver 1 will turn the screw. This is because its shape/structure matches the shape/structure of the screw allowing it to perform the function of turning.

2. Students won't be able to grasp the pencil because their thumbs are taped down. It limits the function of the structure!

3. a. Scooping: Spoonbill, its shape allows for it to scoop fish like a spoon.

b. Ripping meat: Eagle, its claw-like, sharp beak can cut easily

c. Sipping nectar: Hummingbird, its long beak allows it to reach deep into the flower (it's actually a long "tongue" that sips the nectar!)

d. A bird with a sharp, pointed beak will only be able to eat foods it can stab and/or grab. If the food requires ripping or scooping, the shape of the beak will not allow it.

Station 7

1. a. Answers may vary but can include the Burmese Python could eat other living things or it could take over an organism's habitat, etc.

b. Answers may vary but can include the Burmese Python's population will grow and it can change the ecosystem or it could run out of space and move to another area, etc.

c. Answers may vary but can include trying to get rid of the Burmese Python by hunting or introducing a predator to the snake.

CCCs Review

1. __c____ Cause and Effect	a. Observing the repeating moon phases
2. __e____ Systems and System Models	b. Animals have various shaped hands for specific uses.
3. __b____ Structure and Function	c. Poke an inflated balloon with a needle and it pops
4. ___a___ Patterns	d. Energy from the sun turns water to water vapor
5. __d____ Energy and Matter	e. Your circulatory system pumps blood throughout your body and includes blood, blood vessels, and your heart.
6. ___f___ Stability and Change	f. Our global climate has been changing and temperatures have been increasing over time.
7. ___g___ Scale, Proportion, and Quantity	g. If Earth's history were divided into 24 hours, humans arrived in the final second.

Display Labels – Print, cut, laminate and display these labels where students can see them. Put a check mark next to the applicable one/s or only display relevant concepts for the lesson/unit!

Crosscutting Concepts

Patterns

Cause & Effect

Structure & Function

Scale, Proportion, & Quantity

Energy & Matter

Stability & Change

Systems & System Models

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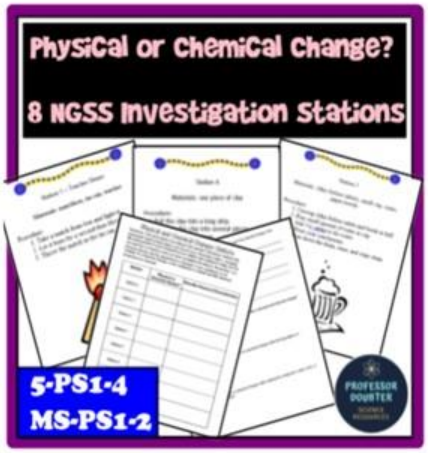
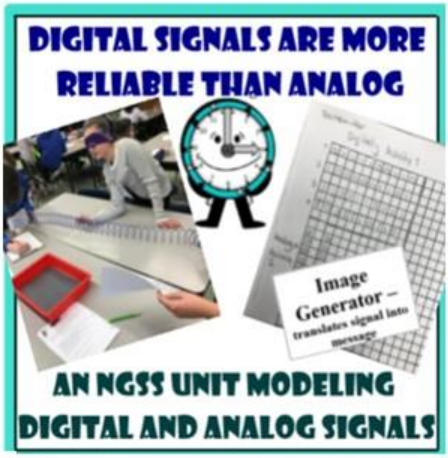
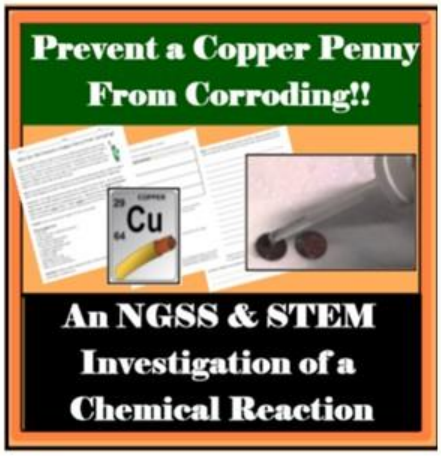
~Melissa Fahy
"Professor Doubter"







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