5E Lesson Plan

Lesson 1: Water on Earth

Teacher(s): Jessica Pepple, Treshonda Rutledge, Michelle Burroughs, Lynne Cohen

Dates: June 20, 2018

Subject/Grade Level: Science/5th Grade

MATERIALS:
Water Cycle Lab document
3 plastic cups
ice cubes
Hot water
Thermostat to hold the hot water
food coloring
masking tape
Presentation: https://docs.google.com/presentation/d/1i-_fQFzCfEEAly1AneSTYC2XNuFHV-L4TIm8qtQ03Vg/edit?usp=sharing

NC SCOS Essential Standards and Clarifying Objectives

SC.5.E.7.1: Create a **model** to **explain** the parts of the **water cycle**. Water can be a gas, a liquid, or a **solid** and can go back and forth from one state to another.
SC.5.E.7.2: Recognize that the ocean is an integral part of the **water cycle** and is connected to all of Earth's **water reservoirs** via **evaporation** and **precipitation** processes.
SC.5.N.1.1: Define a problem, **use** appropriate reference materials to support scientific understanding, **plan** and **carry out** scientific **investigations** of various types such as: systematic **observations**, experiments requiring the identification of **variables,** collecting and organizing **data**, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

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ESOL & ESE STRATEGIES:

ELL Support

When introducing vocabulary, be aware that some letter/ sound combinations may be challenging for English learners, particularly /sh/ in *evaporation, condensation,* and *precipitation*. Provide a clear model for pronunciation.

Emerging Level After you have introduced the vocabulary, use each word in a sentence. Have students point to the word you have used.

Expanding Level Describe each word without identifying it. Then have students identify the word you defined by saying it aloud chorally.

Bridging Level Invite student pairs to come forward. One student will ask, What is _____? The other student will provide a definition.

Visual Kinesthetic Vocabulary Have students cut out and fill in the Dinah Zike Visual Kinesthetic Vocabulary from page VKV8 in the ***Be a Scientist Notebook***.

Students will describe the words, condensation and evaporation. Encourage students to use the vocabulary words that they have learned so far when completing this activity.

Accommodations:

Extended time on assignment (teacher approval) Using multiple media and/or supplemental materials Using linguistic modifications Individualized instruction and/or assignment Using written and pictorial forms to teach Adjusting or shortening assignments Hands on experiences Small group instruction	Cooperative learning groups Defining content area language or terms for students Technology for writing assignments Reducing oral and written directions and information Adapting written and materials to facilitate comprehension. Making use of context clues Differentiated Instruction

LESSON OBJECTIVE(S):

Students will…

- investigate how the water cycle works.
- recognize the important role the ocean plays in the water cycle.

ESSENTIAL QUESTION(S):

What is the water cycle?

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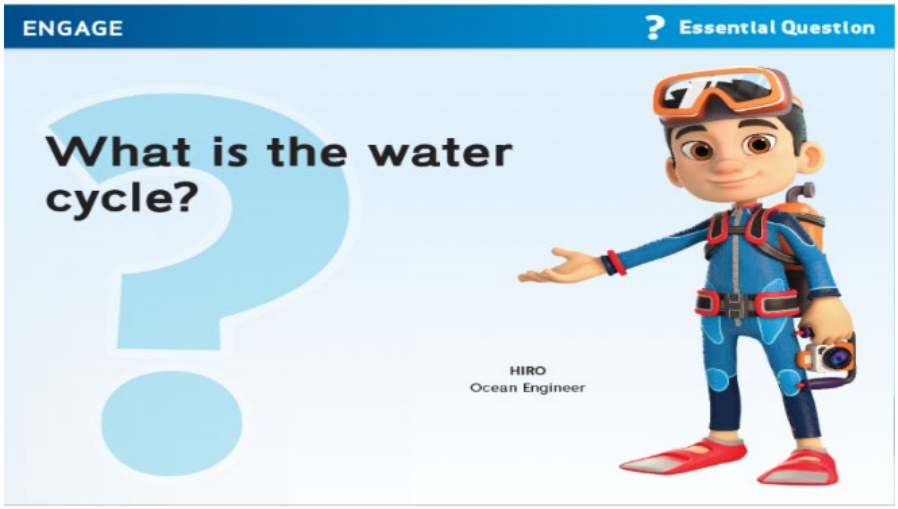


Differentiation strategies to meet diverse learner needs:

Emergent Level: After you have introduced the vocabulary, use each word in a sentence. Have students point to the word you have used.

Expanding Level: Describe each word without identifying it. Then have students identify the word you defined by saying it aloud chorally.

Bridging Level: Invite student pairs to come forward. One student will ask, "What is ____"? The other student will provide a definition.

Kinesthetic Learners: Have students cut out and fill out the Dinah Zike Visual Kinesthetic Vocabulary.

STUDENT COMMON MISCONCEPTIONS

- Students might not be aware that water can seep through the sediment as groundwater and collect underground in aquifers. They might only know about reservoirs because these resources are aboveground and can be seen more easily.
- Students might not be aware that adequate water supplies are needed for more than just human consumption. Freshwater is needed to grow crops and to raise animals. Point out the seriousness of droughts and their potential to disrupt life for people far away who rely on crops grown inside the drought area.

MATERIALS

- **ENGAGE**
  - Laptop, devices, projecting device, access to internet
- **EXPLORE**
  - clear container, warm water, plastic wrap, large rubber band, marble, ice cubes
- **EXPLAIN**
  - The Water Cycle Simulation
- **EVALUATE**
  - world map, graph paper, and colored pencils.

PRE ASSESSMENT (.5 day)

1. **Option 1:** Have students take the electronic pre-assessment via website like socrative, kahoot, or formative.

a. goformative.com/join
b. RBJYDY

2. **Option 2:** Conduct the verbal pre-assessment.
   a. Review slides 2-3 with students.
   b. Say : *"Take 20 seconds to think about each of these students' statements. Decide whether you agree with either of the students statements or if you have your own opinion about what you think covers Earth."*
   c. Do a Round Robin where kids share what they think covers Earth, then say: *" I love your thinking…let's explore this more. We will start by watching a short clip."*

ENGAGEMENT (.5 day)

3. Watch the video "Waves" with the students.
   a. Have students record their questions about the video on page 123 in the Be a Scientist Notebook.

      If students have trouble generating questions, Ask:
      1. *What did you see in the video?*
      2. *What did you notice about the waves?*
      3. *What did you wonder about what you saw in the video?*
      4. *What interests you about waves?*

4. Introduce the desalination engineer STEM career connection. *(Page 123 in Be A Scientist Notebook)*
   a. Ask the following two questions and have students answer using a Sticky Note Storm. (https://www.weareteachers.com/5-fun-alternatives-to-think-pair-share/)
      i. Why would the career connection be a desalination engineer?
      ii. Why would a desalination engineer be interested in waves?
      iii. What would happen if we did not have desalination engineers?

5. Introduce students to topic with question: "What is the water cycle?"
   a. Create a circle map on chart paper with student responses.
   b. Start a KWL chart (do the K & W now) with students to determine what they **know**, what they **want to know** to be able to answer the EQ.
   c. Turn & Talk. Give students 2 minutes to turn and talk to their partner about ways they can **learn** what they brainstormed in the **want to know** column of the KWL chart. Have a few students share out their responses.
   d. Develop an **"I will…"** statement with the students that summarizes how they will research to obtain the information necessary to answer the EQ.
      i. Record this **I will statement** somewhere in the classroom where it will be available throughout the entire unit.

EXPLORATION (1 day)

Student Grouping: Small groups of 3-4 students
Purpose: Students will create a model of the water cycle.
What to Expect: Students will fill the container with water and ice, and watch as the water evaporates

and ice melts.
Advance Preparation: You may want to make sure you have access to warm water and a cooler to place the ice in.

Activity Directions:

1. **Read the steps of the investigation** on page 125 in the Be a Scientist Notebook together with students.
2. **Make a Prediction:** Help students make a prediction. *Remind them that a prediction is a statement of what they expect to observe in the future. Tell them to write their prediction on page 125 in the Be a Scientist Notebook. Then have students explain their prediction based on previous observations.*
3. **Carry Out an Investigation.**
    - *Students need to make sure the rubber band has completely secured the plastic wrap. If it is not secure then the marble and the ice will fall through.*
    - *The container could be put into direct sunlight as this will accelerate the process of condensation.*
4. Have students answer the questions on pages 126 in the Be a Scientist Notebook.

"Big Idea" conceptual questions the teacher will use:

- **Did your results support your prediction?** *Sample answer: Yes. The water vapor condensed when it made contact with a colder surface. It then returned to liquid as it collected on the plastic wrap.*
- **What do you think causes the condensation?** *Sample answer: Condensation occurs when the water vapor (water particles that are too small and too spread out to see and are always in motion) in the air comes in contact with a cool surface, slowing the motion of the particles enough to change them from gas to liquid, forming water drops on the cool surface.*
- **What is one way to speed up condensation?** *Sample answer: The warmer the water is, the faster condensation occurs.*

Differentiated Instruction

Approaching Level Ask students whether the water cycle is a physical or chemical change and to explain their answer.
On Level Have students form small groups and discuss how different their lives would be if they did not have easy access to safe drinking water. Ask volunteers to share their groups' ideas.
Beyond Level Have students research where their local drinking water comes from and what steps are taken to ensure that it is safe.

EXPLANATION (.5 day)
Student explanations should precede introduction of terms or explanations by the teacher.
Target(s):

- Students will explain how the water cycle works.
- Students will describe the effects of water being added or removed from their habitat.

Higher Order Thinking Questions (HOTS):

- How could too much water in an ecosystem affect the geosphere and biosphere?
  Sample answer: too much water could increase erosion. Some animals and plants may die, while other plants and animals may flourish.
- How do plants help move water in the water cycle?
  Sample answer: Plants take up water from the ground. Water then evaporates from their leaves into the atmosphere.

Before introducing the vocabulary, be sure that students have reviewed what solid, liquid, and gas means.

Vocabulary:

- ✓ Water cycle: the continuous movement of water between Earth's surface and the air, changing from liquid into gas into liquid.
- ✓ Reservoir: a storage area for fresh water.
- ✓ Evaporation: a process through which a liquid changes into a gas.
- ✓ Condensation: the changing of a gas into a liquid as heat is moved.
- ✓ Precipitation: water that falls from clouds to the ground in the form of rain, sleet, hail or snow.
- ✓ Storage: the process of water being stored on Earth's surface in the ground or as a water surface.

ELABORATION (.5 day)

5. Describe how students will develop a more sophisticated understanding of the concept. Students will use the section in the Be a Scientist Notebook on pages 131 to demonstrate close reading strategies and develop a deeper comprehension of what they just learned. Students will answer questions on pages 131 and 132 in their scientist notebook.
6. What vocabulary will be introduced and how will it connect to students' observations? Previous vocabulary is in the explanation lesson plan. However, students will receive the following questions, if they are still unsure of how to demonstrate understanding of the water cycle: What could happen to water after it rains? Sample Answer: It can runoff, it can soak into the ground, or it can make a puddle and then evaporate. How does transpiration occur in trees? Sample answer: Trees soak up water with their roots and then water evaporates from the leaves and enters the atmosphere.
7. Writing in Science: Students should demonstrate an understanding of how water cycles through the system. If students were not able to write their paragraph, have them revisit some activities in the lesson. Students should record their paragraph on a separate sheet of paper.
8. How is this knowledge applied in our daily lives? Connections in science: As a model- If this is the first time you have taught models, help students understand that models are a way of showing something that is too big to view all at once. An example is a map of an area or a model of the Lincoln Memorial. ASK: Have you ever seen a model of Earth? Sample answer: Yes, there is a globe in the classroom. Ask: What are some other things you have seen models of either at home or school? Sample answer: I have seen models of landmarks, cars, and even people.

EVALUATION (.5 day)

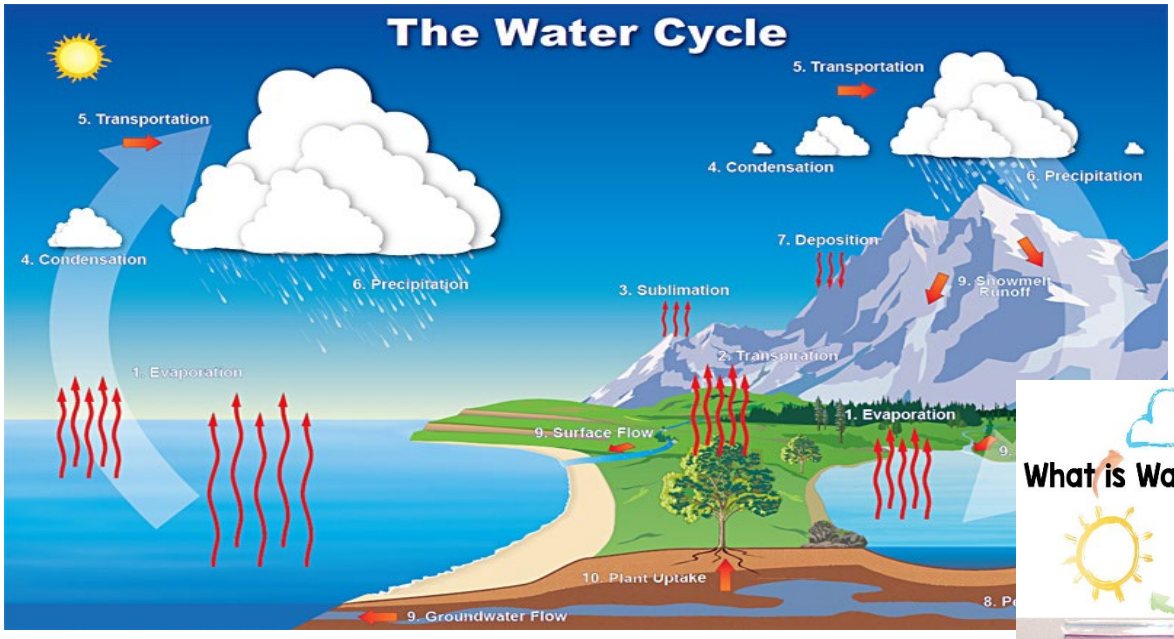
9. How will students demonstrate that they have achieved the lesson objective?
10. This should be embedded throughout the lesson as well as at the end of the lesson

Students will adhere to a performance task of identifying the amount of salt and freshwater that is on Earth. Students will read the steps of the investigation in their Be a Scientist Notebook on page 132. Students will use the sequence graphic organizer to explain the movement of water in the water cycle. Questions to be used during the lesson: Where are you most likely to find estuaries on the map? Sample answer: Estuaries would be at a place where fresh water bodies meets bodies with higher salinity, such as when a river flows into the ocean.

Where can you find bodies of water with higher salinity other than the ocean? Sample answer: Some lakes, such as the Great Salt Lake and the Dead Sea, contain higher amounts of salt.
Students will also be able to create a model of the water cycle. Please see the following description for expected teacher and student actions for the water cycle lab.

Optional*

Students that are receiving tier 3 support for the water cycle lesson can be presented with the option of creating the water cycle in a Ziploc bag. Instructions are available in the Google docs drive.



Evaluation/Performance Task

Where Water is Found

small groups 30 min(s)

Materials world map, graph paper, colored pencils

Purpose Students will better understand how much of Earth's water is salt water and how much is freshwater.

Advanced Preparation If your classroom does not have a large world map, you may need to obtain one. Alternatively, you could use a world map in an atlas or textbook. If you choose this option you may want students to work in small groups or project one on an electronic white board. Point out that students already saw information about Earth's hydrosphere. Explain that now they will complete a hands-on activity about where water is found on Earth.

Read the steps of the investigation on page 133 in the ***Be a Scientist Notebook*** together with students.

Make a Model

1 **Review** a world map with students. Have students identify locations of freshwater and saltwater.

2 **Record Data** You might want to point out smaller water features, such as streams and rivers. Students may need help understanding terms that describe water features, such as bay, fjord, or sound. Help students recognize features on the map that indicate areas of ice or snow. Have students record their data on page 133 in the ***Be a Scientist Notebook***.

3 **Analyze Data** Remind students that some water features vary greatly in size. Students should use their best judgment to order the water features from largest to smallest.

4 Students may not know whether or not some water features are fresh water or salt water. Suggest they look up the body of water online or in an encyclopedia to find out.

Review with students the method of using graph paper. Discuss how to mark large areas on the graph paper to represent large areas of Earth's water.

5 Students will make a graph to show how much of Earth's water is saltwater, frozen freshwater, and freshwater. Remind students that one square is equal to one percent.

Have students answer the questions on pages 133–134 in the ***Be a Scientist Notebook***.

Talk About It

In this activity you studied a map to learn more about Earth's water features.

ASK:

- *Where are you most likely to find estuaries on the map? Sample answer: Estuaries would be at a place where fresh water bodies meets bodies with higher salinity, such as when a river flows into the ocean.*

- *Where can you find bodies of water with higher salinity other than the ocean? Sample answer: Some lakes, such as the Great Salt Lake and the Dead Sea, contain higher amounts of salt.*
- *Where can you find freshwater that is not shown on the map? Sample answer: Ground water is often fresh water, but it is not shown on the map because it is underground.*

Connections in Science

Models

If this is the first time you have taught models, help students understand that models are a way of showing something that is too big to view all at once. An example is a map of an area or a model of the Lincoln Memorial.

ASK:

Have you ever seen a model of Earth? Sample answer: Yes, there is a globe in the classroom.

What are some other things you have seen models of either at home or at school? Sample answer: I have seen models of landmarks, cars, and even people.

Have students answer the questions on page 135 in the ***Be a Scientist Notebook***.

Essential Question

What is the water cycle?

Have students refer to the answer they wrote to this question on page 124 in the ***Be a Scientist Notebook*** and see if and how their thinking has changed. Discuss and share their answers as a large group. Have students answer the Essential Question on page 135 in the ***Be a Scientist Notebook***.

The Nature of Science

I did research to obtain information.

Have the students refer to the "I will…" and "I can…" statements on pages 124 and 130 in the ***Be a Scientist Notebook***.

ASK: Have you researched to obtain information? If so, how? Sample answer: I researched and found out that the water cycle can begin at any point. It can begin as ice or condensation.

Help students record the "I did…" statement on page 135 of the ***Be a Scientist Notebook***.

Hands On Water Cycle Activity

(Lab copies for students are on a separate hand-out)

Collaborative Structure: 10 min – Allow students in table groups to complete the water cycle lab and label diagram and descriptions.

Independent work. Please circulate and read student responses, address any misconceptions with individual students.

Connection to Learning 2min

Today's lesson focused on the water cycle and how the ocean is an integral part of it. The model activity provided a simulation of how the water cycle is ongoing. Remember……water is 75% of the world and plays a huge part in the water cycle. (97% salt, 2% frozen fresh water, 1% fresh water)
Clouds form in cold temperatures when water vapor beads up and begins to condense.

Exit Slip 2 min

What is the process that involves droplets of water joining together to become clouds?

A) conduction
B) evaporation
C) precipitation
D) condensation

5E Lesson Plan

Lesson 2: Types of Precipitation

Teacher(s): Jessica Pebbles, Treshonda Rutledge, Michelle Burroughs, Lynne Cohen

Dates: June 20, 2018 **Approx. Length:** 3 class periods (4 if additional time and/or remediation needed)

Subject/Grade Level: Science/5th Grade

NGSSS Essential Standards:

- **SC.5.E.7.4: Distinguish** among the various forms of **precipitation** (rain, snow, sleet, and hail), **making connections** to the **weather** in a particular place and time.
- **SC.5.N.1.1: Define** a problem, **use** appropriate reference materials to support scientific understanding, **plan** and **carry out** scientific **investigations** of various types such as: systematic **observations**, experiments requiring the identification of **variables,** collecting and organizing **data**, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

LESSON OBJECTIVE(S):

The students have just finished their lesson on the hydrologic cycle, now they must begin to connect that with weather and precipitation.

Students will be able to…

- Identify precipitation as rain, snow, sleet, or hail and describe the characteristics of each.
- Apply their understanding to a real-world precipitation event. Create a model of the event and depict (visually or orally) the consequences on human activity.

ESSENTIAL QUESTION(S):

- How do you read a precipitation map?
- What are the characteristics of rain, snow, sleet and hail?

Differentiation strategies to meet diverse learner needs:

- **Universal Design:** Color-coded Discussion prompt cards with sentence starters on the back.
- **Universal Design (ELL focused)**: Text questions from online tutorial modified to minimize passive voice and present perfect / future perfect verb forms.
- **Assessment Accommodations (Individual, Unspoken):** EL and Literacy-challenged students may earn an equivalent grade, rather than by writing full sentences, by writing partial sentences or a list of key words accompanied by other evidence of understanding, such as discussion with peers, discussion with teacher, or attempts to better understand the activity (such as rewatch, lookup, or translate).

POSSIBLE STUDENT MISCONCEPTIONS

- Rain falls from a cloud when the pool of water in the cloud becomes too large, so the cloud can no longer hold the water inside (American Association for the Advancement of Science, 2018).
- Rain falls from a cloud when two clouds collide, causing them to burst open (American Association for the Advancement of Science, 2018).

MATERIALS

- **One-to-One Student Devices** such as laptops or tablets. Students without devices may share with a partner but should do their own work during the individual portion, and during group activity should contribute more to the hands-on craft.
- **CPalms tutorial:** "Raindrops Keep Falling on my Head… OR WAIT, is it Snow? Or Sleet? Or Hail?" http://www.cpalms.org/Public/PreviewResourceStudentTutorial/Preview/110515
- **Prior Knowledge Questions Sheet** (included in lesson plan)
- **Tutorial Worksheet:** https://docs.google.com/document/d/1Ig6QmXjD24TSBvnZe6B_ZJeZEIVW7OFo_04pFbH4Bh4/edit?usp=sharing
- **Video**: "Observe Precipitation" https://florida.pbslearningmedia.org/resource/ess05.sci.ess.watcyc.precipitation/observe-precipitation/#.WyVdiu0vzrd
- **Pencil or Pen**
- **Projector** and Links in Lesson Plan
- **Craft Supplies** such as colored pencils, markers, crayons, poster sheet, construction paper, glue, tape, string, cotton balls *(whatever is available)*.

ENGAGE ***(.5 day)***

Bellwork - Students are shown images of cloud formations and asked to jot down in their notebooks an answer to the question: "Where do clouds come from? What happens inside clouds?"

Cloud 1 Cloud 2 Cloud 3 Cloud 4 Cloud 5 (Hackett et. al., 2017)

Start of Class - Students use Prior Knowledge sheet as a foundation to start a discussion regarding prior knowledge of weather.

1. **Individual response** (5 mins) Students respond to as many statements as possible on their own in the time given.
2. **Share & Revise** (3 mins): Students may talk with one another and make revisions or additions to their sheets.

Prior Knowledge: Weather & Precipitation

Directions: *complete the sheet by identifying if the statement is true or false, or filling in the missing words. Then, in the box below the statement, write something else you know about it, or*

something you are curious to find out.	
Statement: Water can be found in three forms: solid, liquid, or gas.	True False
Something else I know about this topic, or am curious about:	
Statement: Water in gas form is called water _____.	
Something else I know about this topic, or am curious about:	
Statement: Weather is not specific to a specific place and time.	True False
Something else I know about this topic, or am curious about:	
Statement: Some types of weather I know about are:	1. _____ 2. _____ 3. _____ 4. _____
Something else I know about this topic, or am curious about:	
Statement: Precipitation is part of the water cycle that involves water changing *from* a gas, *to* liquid or solid form, and falling from the sky.	True False
Something else I know about this topic, or am curious about:	
What is your opinion? There were puddles on the sidewalk in the morning when Kevin and his friends walked to school. When they walked home, the puddles were gone. They each had different ideas about where the water that was in the puddles went. ★ Kevin: I think it went up to the Sun. ★ Lucy: I think it went up to the clouds. ★ Doug: I think it went into the air. ★ Becca: I think it just disappeared.	
Who do you agree with the most? Why?	

(Hackett et. al., 2017)

3. **Group Discussion** (10 mins) - Group discussion of answers and additional information. Teacher acts as facilitator only.

a. Vocabulary volunteered by students is added to a word bank on the board.
b. Questions brought up by students are written on the board for further exploration.
c. During discussion, students ask to speak by raising a discussion starter card in the air (see below).
    i. Teacher starts off the discussion by asking who wants to go first. Those who want to start off raise a yellow card. Teacher either chooses a starting student or gives a condition such as, "the person who starts first is the person who most recently saw snow!"
    ii. After the initial choice, the **student who is speaking selects the next student to go** from among those raising cards.

Details about Universal Design Differentiation - Discussion Starter Cards

To encourage discussion, laminated, colored index cards are on every table (At least one set per pair of students). On the front is the word, and on the back are some sentence starters.

- ★ **Yellow** - "New Opinion / Disagree" ("I think that…" / "I understand what _____ said, but I have a different idea. I think…" / "That's interesting. Have you thought about...")
- ★ **Red** - "Agree / Further examples" ("I agree with what ___ said, and would like to add…" / "I've also seen an example of what ____ said....")
- ★ **Blue** - "Define / Clarify" ("Can you remind me what ____ means?" / "What is the definition of ____?")
- ★ **Purple** - "Use in a sentence" ("How would you use the word _____ in a sentence?")
- ★ **Green** - "Give example (word or idea)" ("Can you give an example of what you mean?" / "What makes you think that?" / "When have you seen that word used?"

Students should raise the card along with their hand.

EXPLORE (Activity) ***(.5 day)***

Students open and move through the first 17 slides of the Cpalms tutorial "Raindrops Keep Falling on my Head… OR WAIT, is it Snow? Or Sleet? Or Hail?" (Lengacher, n.d.)

- During this activity, students interpret a color precipitation map, then learn about four types of precipitation, their characteristics and the way they are formed.
- Students stop at slide 17.
- As students move through the tutorial, they may fill out their text-dependent questions on this worksheet (Lengacher, n.d.) (*modified from original).*

(MID-EXPLORE) FORMATIVE ASSESSMENT

- Teacher observes, circulates, and gives minor credit for sheet completion (Grade is aggregate with other minor formatives throughout the quarter).
- Students can earn a full point (complete answers using textual evidence), a half point (some questions unanswered or not answered based on textual evidence), or no credit (little to no work done).

a. ***Directed Accomodation****: EL and Literacy-challenged students may earn an equivalent grade, rather than by writing full sentences, by writing partial sentences or a list of key words accompanied by other evidence of understanding, such as discussion with peers, discussion with teacher, or attempts to better understand the activity (such as rewatch, lookup, or translate).*

(MID-EXPLORE) DAY 1 EXIT TICKET (No grade)

- Students choose either the "Look forward" or "Think back" question to answer on an index card and turn in.
  a. *This is ungraded - used by teacher to guide further instruction.*
  b. ***Accommodation****: If students take longer on the activity & worksheet, allow them to continue.* ***ELs****: For their exit ticket, they may write new words they learned from this lesson, and its definition in English or Spanish.*
  c. ***Gifted/Accelerated differentiation:*** *Students who finish quickly with good understanding should attempt both "look forward" and "think back", or choose one and then help another student who is struggling. For this, they can earn an additional minor formative grade added into their average.*

EXPLAIN ***(.5 Day - Starts Day 2)***

- **Students watch** "Observe Precipitation" video https://florida.pbslearningmedia.org/resource/ess05.sci.ess.watcyc.precipitation/observe-precipitation/#.WyVdiu0vzrd (WGBH Educational Foundation, 2006)
- **Students discuss** the answers to the following questions as an informal group discussion. Teacher reads each aloud and projects them on the board with visuals, then students discuss with minimal teacher input. *Either teacher or volunteer students continue to jot down vocabulary and key points on board.*
  a. What substance makes up rain, hail, and snow?
  b. How are rain, hail, and snow alike? How are they different?
  c. Have you experienced rain? Hail? Snow? How would you describe each form of precipitation to someone who had never experienced it?
  d. What is the source of the water that makes rain, hail, and snow?
  e. What happens to the water from rain, hail, or snow after the precipitation falls to the ground?
  f. How can precipitation affect humans positively or negatively?
    i. ***ELL Accommodation:*** *for this language-heavy portion, ELL students can be given a graphic organizer with boxes for rain, hail, and snow (pictures and words), with a word bank on the bottom. They can either quietly work to complete the worksheet during the discussion (beginner level), or can contribute to the best of their ability using the word bank as resource.*
- **Students add final terms and questions** to the board before starting project. These terms are left on the board for students to refer to during their research and presentations.

ELABORATE (Research & Model Creation) ***(1.5 class periods)***

- Students work in groups of 3 (or 2).
- Students use their laptops to research extreme weather events in the US involving rain, snow, sleet or hail. Examples might include hurricanes, winter storms, floods, etc.
    - Start off point: https://www.climate.gov/news-features/category/extreme-events
- Students create a visual representation (such as a poster) of the chosen event. It should include:
    - The type of precipitation (visually depicted).
    - How/why the precipitation formed.
    - Any danger or damage caused by the event.
    - How it complicated human lives.
    - How people dealt with the weather: did anyone forecast it? Did people prepare? Evacuate? How did they clean up?
- Each student group present their findings and explains their model in a brief 5 minute presentation.
- Students are given the grading rubric along with a description of the assignment.
    - ***ELL Accommodation****: replace "description / explanation" with "depiction". Rubric grading should reflect flexibility that accounts for student's level of language mastery.*
    - ***ESE Accommodation:*** *Student may spend a portion of the group-work time working individually with teacher or available aide on remediation.*
    - ***Gifted/Accelerated Extension****: Students may add details on how the outcome of the weather event affected later policies and/or public education efforts.*

EVALUATE

- **Day 1:** Formative Assessment (Graded) and Exit Ticket (Ungraded) - see "Explore" section for details

- **Day 2:** Research & Model Project graded per rubric (on next page)

RUBRIC

Points:	**3**	**2**	**1**	**0**
Students depict either rain, snow, sleet or hail and describe its characteristics.	Precipitation type is named and characteristics fully described.	Minimal characteristics of precipitation type is described.	Type of precipitation is described but no characteristics are included.	No evidence of goal is present.
Students depict either rain, snow, sleet or hail, and describe how it forms.	Full description of how precipitation formed in context of the time and place.	Minimal description of how the precipitation forms is present.	Type of precipitation is described but not how it forms or formed.	No evidence of goal is present.
Students describe the	Complete and reasonable	Complete and reasonable	Explanation of at least 1 danger to	No evidence of goal is

effect on human lives, such as danger, damage, and other complications.	explanation of at least 1 danger and 1 other effect on human life.	explanation of at least 1 danger to human life.	human life, but lacks rational connection to event.	present.
How people dealt with the weather: did anyone forecast it? Did people prepare? Evacuate? How did they clean up?	Complete and reasonable explanation of at least 2 examples of humans preparing for and/or cleaning up from the weather event.	Complete and reasonable explanation of at least 1 example of humans preparing for and/or cleaning up from the weather event.	Explanation of at least 1 human preparation method, but lacks rational connection to event.	No evidence of goal is present.
Individual Student participation in creativity, group work and/or presentation	Student participated well in at all three areas: creativity, group work, and presentation	Student participated well in at least two areas: creativity, group work, presentation	Student participated well in at least one area: creativity, group work, presentation	Student evidence of participation was minimal.
Total Points Possible				**15**

5E Lesson Plan

Lesson 3: How Weather Happens

Teacher(s): Jessica Pepple, Treshonda Rutledge, Michelle Burroughs, Lynne Cohen

Dates: June 20, 2018 **Approx. Length:** 3 class periods

Subject/Grade Level: Science/5th Grade

Topic: Factors Affecting Weather

NGSSS Essential Standards:

- SC.5.E.7.3 **Recognize** how **air temperature**, **barometric pressure**, **humidity**, **wind** speed and direction, and **precipitation** **determine** the weather in a particular place and time.
- **SC.5.N.1.1:** **Define** a problem, **use** appropriate reference materials to support scientific understanding, **plan** and **carry out** scientific **investigations** of various types such as: systematic **observations**, experiments requiring the identification of **variables,** collecting and organizing **data**, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

LESSON OBJECTIVE(S):

The students have just finished recognizing and describing types of precipitation and doing a small project about extreme weather. Now they will explore the factors that influence weather systems.

Students will be able to…

- Answer questions about weather-producing factors using evidence from station activities involving observation, experimentation, reading, and using models and simulations.
- Produce a document, creative product or performance describing the formation of hurricane conditions involving air temperature, pressure, humidity, wind, and precipitation.

ESSENTIAL QUESTION(S):

- What causes weather?
- What does a meteorologist measure so that he or she can predict the weather?

Differentiation strategies to meet diverse learner needs:

- **Universal Design:** Color-coded Discussion prompt cards with sentence starters on the back.
- **Universal Design (ELL focused)**:

STUDENT COMMON MISCONCEPTIONS

- Water evaporates into the air only when the air is very warm (American Association for the Advancement of Science, 2018).
- A change in air temperature does not have an effect on whether clouds and fog form or rain falls (American Association for the Advancement of Science, 2018).
- The direction/speed air is moving cannot be measured (American Association for the Advancement of Science, 2018).

MATERIALS

- **One-to-One Student Devices** such as laptops or tablets.
- **Pencil or Pen**
- **Projector** and Links in Lesson Plan

- **Notebook**
- **Station 1 Materials**
  - safety goggles
  - scissors
  - cardboard
  - clear plastic box (such as square 1-gallon fish tank)
  - aluminum foil
  - 4 cups of cold water (from tap or thermos)
  - measuring cup
  - 4 cups of warm water (from electric kettle, cooled slightly)
  - red and blue food coloring
- **Station 2 Materials**
  - A large, clean, plastic, fizzy drink bottle.
  - Warm water
  - Matches
  - Optional thermometer
  - Bike pump & attachment for bottle
- **Station 3 Materials**
  - Glasses
  - Water basin
  - index cards
  - tap water
  - Flash-enabled laptop or tablet
  - "Aim a hurricane": https://www.nhc.noaa.gov/outreach/games/movncane.htm
- **Station 4 Materials**
  - Anemometer 1:
    - 5 three ounce paper Dixie Cups
    - 2 soda straws
    - pin
    - paper punch
    - scissors
    - stapler
    - sharp pencil with an eraser
  - Anemometer 2:
    - 30cm of strong THREAD or fishing line
    - A PING PONG or other small, light, plastic ball
    - SELLOTAPE
    - PROTRACTOR
    - A piece of strong CARDBOARD (15cm x 10cm)
  - Standing or battery-operated Fan
- **Station 5 Materials**
  - Printouts of Article in Lesson Plan

- Flash-enabled laptop or tablet
- "Create a hurricane": https://www.nhc.noaa.gov/outreach/games/canelab.htm

- **Explain Materials**
  - Handout in Lesson Plan
  - Student textbook

ENGAGE

1. When students enter, a statement from a meteorologist is projected on the board: https://drive.google.com/open?id=1uuPLIyYzRuao37jVevRh8prFojiVCBgc (Hackett et. al., 2017)
   a. Once class starts, Teacher (or student volunteer/s) read it out loud.
2. Students are asked the question: *What factors does a meteorologist measure so that he or she can predict the weather? We will brainstorm as many as we can without looking it up.*
   a. Students brainstorm any factors they can think of - those are written on the board. At this point calling out is allowed.
3. Students are asked: *While we watch this next video, jot down in your notebook anything you notice or remember about weather prediction.*
   a. *Here are some guiding questions:*
      i. *What types of instruments do meteorologists use to collect information about local weather conditions?* (Hackett et. al., 2017)
      ii. *Why is it important for meteorologists to measure variables constantly?* (Hackett et. al., 2017)
      iii. *What could happen if a meteorologist is wrong about a major weather event?*
   b. Students watch video "How are weather forecasts made?"
   c. Brainstorm continues and additional phrases and words are added to the unit vocabulary / concept bank on the board.

EXPLORE - Exploration Stations (1 day)

Students go to stations and perform a task at each one.

1. **Station 1: Temperature - Warm and Cold Fronts**
   - Demonstration of warm air rising and cold air sinking. Students perform the experiment described on Page 1 of https://drive.google.com/file/d/1UevSJiLeXIYHelYqMc1bp5vlYf2nVNWE/view?usp=sharing (Hackett et. al., 2017)
     - *Teacher prepares as much set-up as possible prior to class to modify this activity for stations.*
   - Result should look like this: https://www.youtube.com/watch?v=Ak9CBB1bTcc&t=11s (Canada Science and Technology Museum, 2010)
   - **Student Evidence**: In their notebook, Student answers the questions:
     - **Before Experiment:** "What do you think will happen?"
     - **After Experiment:**
       - "What did happen? Did it match your prediction?"

- "What can you infer about what happens when warm and cold air masses meet in Earth's atmosphere?"

2. **Station 2: Humidity - Making fog**
    - Students perform the cloud in a bottle experiment as described here: http://www.metlink.org/wp-content/uploads/2013/10/cloud-bottle-new.pdf (Royal Meteorological Society, 2017). It is important that students take temperature readings as they perform the experiment.
    - **Student Evidence:** In their notebook, Student answers the questions:
        - "Why did the cloud form?"
        - "When the air is foggy or it feels very moist outside, what do we call that?"
        - "How does this experiment relate to the water cycle? To precipitation?"

3. **Station 3: Barometric (Air) Pressure - "Don't spill a drop - which is heavier, air or water?" / How do hurricanes move?**
    - Students perform an experiment to demonstrate air pressure:
        - Students fill a cup one-third with water.
        - Cover the entire mouth with an index card.
        - Holding the card in place, with the cup over a basin (just in case), student turns it upside down and removes their hand from underneath.
        - "Voilà! Because the water inside the cup is lighter than the air outside, the card is held in place by about 15 pounds of force from the air pushing up, while the force of the water pushing down is only about one pound of force" (Lipper, 2011).
    - Students then use a (flash-enabled) laptop or tablet to access the "Aim a Hurricane" simulator: https://www.nhc.noaa.gov/outreach/games/movncane.htm (COMET Program, 2002)
        - Students should try several scenarios and make observations.
    - **Student evidence**: In their notebook, student answers the questions:
        - "What do you think held the index card in place?"
        - "Would this experiment work in space?"
        - "How do hurricanes move? What does air pressure (also called barometric pressure) have to do with the path of a hurricane?"

4. **Station 4: Wind Speed & Direction - Making an anemometer**
    - Students use a fan and two premade versions of homemade anemometers:
        - http://www.weatherwizkids.com/experiments-anemometer.htm (Weather Wiz Kids, n.d.)
        - http://www.metlink.org/wp-content/uploads/2013/10/anemometer.pdf (Royal Meteorological Society, 2017)
    - **Student evidence**: In their notebook, student answers the questions:
        - "Which type of anemometer is best for measuring wind speed? Best for measuring wind direction? Why?"

- "Why do you think we call these tools anemometers? (you can look this up or make a guess!)"
- "What other tools do meteorologists use?"

5. **Station 5: Create a hurricane**
   - Read about how hurricanes form http://www.weatherwizkids.com/weather-hurricane.htm
   - https://www.nhc.noaa.gov/outreach/games/canelab.htm (Requires flash) (COMET Program, 2002)
   - **Student Evidence:** Students answer questions:
     - "What factors affect whether or not a hurricane will form?"
     - "What conditions lead to a strong hurricane?"

EXPLAIN

- Students read excerpts from their textbook (teacher assisted when needed) and answer the guided reading questions on the worksheet:
- https://drive.google.com/file/d/1lJqTMv-1IeJHaqqa8wTy01q35xJHbqy4/view?usp=sharing

ELABORATION

- Students create a "Public Service Announcement" about conditions that contribute to hurricanes forming using evidence from text, their notes from their station activities, and external research (if desired).
- Announcement may take the form of a poster, a pamphlet, a song, or a recorded performance. May work alone or in a group up to 3.
- Students should include:
  - The roles of air temperature, barometric pressure, humidity, wind, and precipitation.
  - A simple description of each concept.
  - What tools we can use to measure each at home.
  - Three ways we can prepare for hurricanes.
- *Class time may be given, or partially completed at home.*

EVALUATION

- Student evidence from Explore portions & Explain portions are given a minor formative grade. Alternatively, minor grades could be skipped, as the results of all the students' learning should also reflect in their elaboration project.
- "Elaboration" project is given a full grade according to the rubric:

RUBRIC

Points:	**3**	**2**	**1**	**0**
Student depicts role of air temperature & method of	Presentation includes all 3: role, description, and measurement	Presentation includes only 2: role, description, or measurement	Presentation includes only 1: role, description, or measurement	No evidence of goal is present.

measurement.	method.	method.	method.	
Student depicts role of barometric pressure & method of measurement.	Presentation includes all 3: role, description, and measurement method.	Presentation includes only 2: role, description, or measurement method.	Presentation includes only 1: role, description, or measurement method.	No evidence of goal is present.
Student depicts role of humidity & method of measurement.	Presentation includes all 3: role, description, and measurement method.	Presentation includes only 2: role, description, or measurement method.	Presentation includes only 1: role, description, or measurement method.	No evidence of goal is present.
Student depicts role of wind & method of measurement.	Presentation includes all 3: role, description, and measurement method.	Presentation includes only 2: role, description, or measurement method.	Presentation includes only 1: role, description, or measurement method.	No evidence of goal is present.
Student depicts role of precipitation & method of measurement.	Presentation includes all 3: role, description, and measurement method.	Presentation includes only 2: role, description, or measurement method.	Presentation includes only 1: role, description, or measurement method.	No evidence of goal is present.
Student describes 3 ways to prepare.	Student includes 3 ways to prepare.	Student includes 2 ways to prepare.	Student includes 1 way to prepare.	No evidence of goal is present.
Total Points Possible				**18**

5E Lesson Plan

Marzano

Marzano Lesson Segment Addressing Content: ***Complete during Common Planning***		
DQ2 6:Identifying Critical Content 7:Organizing Students to Interact with New Content 8: Previewing New Content 9:Chunking Content into "Digestible Bite" 10:Helping Students Processing New Content 11: Helping Students Elaborating on New Content 12: Helping Students Recording and Representing Knowledge 13: Helping Students Reflecting on Learning	**DQ3** 14: Reviewing Content 15: Organizing Students to Practice and Deepen Knowledge 16: Using Homework 17: Helping Students Examine Similarities and Differences 18: Helping Students Examine Their Reasoning 19: Helping Students Practicing Skills, Strategies, and Processes 20: Helping Students Revising Knowledge	**DQ4** 21: Organizing Students for Cognitively Complex Tasks 22: Engaging Students in Cognitively Complex Tasks Involving Hypothesis Generation and Testing 23: Providing Resources and Guidance for Cognitively Complex Tasks

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