CULMINATING TASK: **Challenge 2**

WHERE'S THE SNOW?

As the storm moved east, why did it snow in some areas but not others?

AT A GLANCE

ACTIVITY DESCRIPTION	MATERIALS
(50 minutes)	
Challenge 2: Where's the Snow? Students examine data as the winter storm moves east across the western interior. They explain why this storm brought precipitation to some locations but not others, drawing on ideas from previous lessons. Students work in small groups to develop explanations. They then share their ideas with the class and come to consensus.	**Challenge 2: Student Activity Sheet** CULMINATING TASK: **Challenge 2** Colored pencils

NGSS Sensemaking

In Challenge 2, students use models developed in Learning Sequences 1, 2, and 3 to explain why some areas in the Rockies got a lot of snow and others did not. Students identify that heavy precipitation is located near an area of low pressure where moist air rises and becomes available for precipitation.

NGSS DIMENSIONS (GRADES 6-8)

- Air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time. Sudden changes in weather can result when different air masses collide.
- Weather is influenced by interactions involving sunlight, the ocean, and the atmosphere. These interactions vary with latitude, altitude, and regional geography, all of which can affect atmospheric flow patterns.
- Apply scientific ideas to construct an explanation for real-world phenomena or events.
- Charts can be used to identify patterns in data.

Teacher Procedures

Challenge 2: Where's the Snow?

1. **Navigate from the previous lesson.** Review what students learned about winter storm Quid in Challenge 1 and revisit the two questions that ended the previous challenge:
   - *What information would you need to decide whether rain or snow will fall during a storm?*
   - *Where is the storm heading next and how do you know?*

   Listen for the following responses:
   - You need to look at temperature. If it's colder in the atmosphere, it will snow.
   - This winter storm will move east because of prevailing surface winds in the midlatitudes.

2. **Discuss where the winter storm is heading.** Project the class map for Challenge 2 and explain that in Challenge 2 students will analyze precipitation data for the winter storm three days after it was in California. The storm is now located in the Rocky Mountains. Their goal is to identify places with heavy precipitation and decide what is causing precipitation in this area.

CT Challenge 2
STEP 1-4

3. **Prepare to complete Challenge 2.** Pass out the *Challenge 2: Student Activity Sheet.* Read the instructions together for Challenge 2 and outline the four steps students will complete. Orient students to what is shown on the map over the four days of the storm. Have students return to their groups/partners from the previous day. Remind students to use their class Consensus Models and Model Idea Tracker to help them decide what is happening to cause heavy precipitation.

4. **Work on Challenge 2 in small groups.** Give students 20 minutes to work on *Challenge 2: Steps 1-4. In Step 1,* students will write the snowfall totals from the data table on their map and identify the communities that had significant snow. In *Step 2,* students use the snowfall map to predict where schools might close. For *Step 3,* students consider patterns in snowfall and why some areas had more snow than others. *Step 4* reminds students of the two things needed for precipitation (rising, cooling air and humidity). Students draw air movement and cloud formation in the cross sections showing low pressure and the front and relate distance from the storm to the amount of snowfall received. *Step 4* continues with students completing the humidity map and determining which locations didn't have enough moisture to result in a storm.

   As students work, circulate the groups and prompt students to draw on previous models and Model Ideas.
   - *Think about how precipitation forms around a front. What's happening to the air along the front?*
   - *What happens to air in a low-pressure area?*
   - *Even though a cold front is passing through all these towns, why might some not get any precipitation? What's an important ingredient that could be missing?*

5. **Discuss Challenge 2 questions as a whole class.** Project the map for Challenge 2 and discuss the following question prompts. Focus on coming to consensus about each question and recording the consensus explanation for the class. Students can continue to edit their answers from *Steps 1-4* if they hear something new or different they'd like to add. Have students share their images of what is happening on a document camera to support their explanations.

Storyline Link
In the previous challenge, students explained that temperature was important for determining precipitation and the storm was heading east.

Developing & Using Models
Student models from Learning Sequences 1 and 2 should help students develop explanations for why it snowed in some places but not others.

Patterns in Data
Students identify patterns in the data tables, looking for relationships between places with heavy snow and average humidity.

SUGGESTED PROMPTS	SAMPLE STUDENT RESPONSES
Where were the communities with heavy snowfall located in relation to the storm?	• These locations are near or just behind the area of low pressure at the northern end of the cold front.
Explain why places like Cortez, Gallup, and Albuquerque didn't get any snowfall at all.	• They are not close enough to the low pressure area, which is necessary for warmer, moist air to rise up into the atmosphere.
Did it always snow in areas that had high humidity? Explain why or why not. Give examples.	• Devils Tower is the only location that had high humidity but absolutely no snow. Since it is the farthest from the low-pressure system, there was no mechanism for the moisture to rise up into the atmosphere. In general, areas with high snowfall did indeed also have high humidity.
Compare the two areas with the highest snowfall to the two areas with the highest humidity.	• The areas with the highest snowfall did indeed have high humidity, but the areas with the highest humidity didn't happen to have all that much snow due to the large distance between them and the storm.
Why do some communities have more snowfall than others? What is happening to air in these areas?	• Areas of low pressure have warm, rising air with moisture. This means there is more moisture rising in this area, so there is a higher potential for more precipitation. (Students' Step 4 drawings may vary but should indicate that an area of low pressure is where warm air, or relatively warm air, with moisture is rising and then cooling to create storms and precipitation.)
Why didn't it snow everywhere?	• Some of the places where it didn't snow were too far from the storm. • Some of the places where it didn't snow had low humidity. That means they didn't have enough moisture in the air for it to snow.
Where might schools close?	• Students' answers may vary but should include all locations with significant snow (Rock Springs, WY; Dinosaur, CO; Vernal, UT). Students may include locations with less snow depending on their experience with snowstorms and school cancelations. (Students will learn more about safety and cancelations in Challenge 3.)

Assessment
Listen to student responses to the Challenge question and/or read their explanation on the Exit Tickets. See if students identify rising, moist air in the area of low pressure as a key factor in the heavy snow.

6. **Return to the Challenge 2 question.** Revisit the question: *"As the storm moved east, why did it snow in some areas but not others?"* Have students discuss an explanation to this question in groups and/or write a response on an Exit Ticket before the end of the lesson.