OVERVIEW

Students will learn about air masses and how they affect weather patterns.

LEARNING TARGETS:

❖ Students learn how air masses flow from regions of high pressure to low pressure, causing weather occurrences.

❖ Students will be able to describe the characteristics of air masses based on their origins.

❖ Students learn sudden changes in weather can result when different air masses collide.

❖ Students will be able to make weather predictions using weather maps.

NGSS STANDARDS

MS Engineering Design

Students who can demonstrate understanding can:

MS-ESS2–5. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.

Clarification Statement: Emphasis is on how 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, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams and visualizations) or obtained through laboratory experiments (such as with condensation).

Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.

MS-ESS2–6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Clarification Statement: Emphasis is on how patterns vary by latitude, altitude and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations..

Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.

Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.	**ESS2.D: Weather and Climate** ♦ Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MSESS2-6)	**Patterns** ♦ Patterns can be used to identify cause-and-effect relationships.

- Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)

- Because these patterns are so complex, weather can only be predicted probabilistically. (MSESS2- 5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

Cause and Effect

- Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

Energy and Matter

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

ENGAGEMENT

Wild weather video to hook students: How does wild weather happen?

Materials	Procedures	Sample Questions / Teacher Hints
- Video clip **Must See! Wild Weather!!!** *(running time: 3:19)* https://www.youtube.com/watch?v=2Jm7FRRIspo	- Show the video to students. - Ask students what they noticed in the video. - Start a chart (parking lot) with student questions.	As questions come up during this lesson, write them on a sticky note and put them on the parking lot. - What did you notice in the video?

EXPLORATION

Students will manipulate air mass cards and place them in the proper geographic locations on an Earth mat to learn about maritime, continental, polar and tropical air masses. Students will then use air mass cards and a simulation to see how air masses move and affect weather.

Materials	Procedures	Sample Questions / Teacher Hints

◆ Earth Mat
 	
◆ Colored Air Mass cards: Teacher will need to cut one red and one blue construction paper per group approximately 3" x 2" to represent a cold and a warm air mass.
 	
Weather Lab
https://ssec.si.edu/weather-lab
	Weather Lab:
	Smithsonian Science Education simulation
	
	1. Put students in small groups and provide each group with an Earth Mat. Students will discuss in small groups the characteristics of the air mass that would form over the various labeled points on the Earth Mat.
	
	2. Science discourse will occur with the whole class to clearly define the characteristics of the air masses.
	
	3. Ask students to answer the following questions:
	
	   a. What characteristics would you use to describe an air mass over points A, B, C, D, E, F and G?
	
	   b. What do you think is the relative temperature for air mass over each location?
	
	   c. What do you think is the moisture content for the air masses over each location?
	
	4. Ask the students what happens to the air masses. Do they move? What do you think makes them move? What happens if they collide?
	
	5. Using colored air mass cards on the Earth Mat, place blue card on point F and red card on point G. Discuss how air masses at points F and G could meet at the asterisk. (This activity will mimic the simulation and provide a model for independent work.)
		◆ Define air mass as a body of air with horizontally uniform temperature, humidity and pressure.
		
		◆ Examples of characteristics: temperature and humidity
		
		A: polar, moist
		B: continental, dry
		C: tropical, moist
		D: tropical, dry
		E: polar, dry
		F: polar, moist
		G: tropical, moist

EXPLORATION CONT'D

6. Smithsonian Simulation—Weather Lab: Work as a class to see the air masses in motion.

    ♦ Ocean Current—Select **Pacific Ocean Gyre**

    ♦ Air Mass 1 — Select 1 **polar**

    ♦ Air Mass 2—Select **tropical**

    ♦ Students will predict what will happen to the weather when the two air masses meet.

    ♦ Click "Next" and choose from three scenarios. Once the correct scenario is chosen, the simulation will play.

    ♦ Then click "Reset."

    Next, let students use different scenarios on their own, choosing their own ocean currents and air masses to manipulate.

EXPLANATION

How wind, landforms, ocean currents and temperatures affect the motion of air masses and weather patterns.

Materials	Procedures	Sample Questions / Teacher Hints
♦ PowerPoint What Affects Weather Patterns ♦ Modified PowerPoint notes	♦ Give each student a modified notes page or have them take their own notes while going through the PowerPoint What Affects Weather Patterns. ♦ Go through the PowerPoint with students.	♦ On Slide 5, students will work with a partner to define the following terms: maritime polar, maritime tropical, continental polar, continental tropical

ENRICH

Options 1:

❖ Students can create a public service announcement for severe weather and design a survival kit for severe weather events.

Option 2:

❖ During a Gallery Walk activity, students use weather symbols and weather maps to make weather predictions about where they live. See directions below.

Materials	Procedures	Sample Questions / Teacher Hints
◆ Weather Maps for Gallery Walk to display, or teacher can find maps on the Weather Channel **(https://weather.com/maps/currentusweather)** ◆ or at the National Oceanic and Atmospheric Administration **(www.weather.gov/forecastmaps)** websites. ◆ **Weather symbols chart** https://scioly.org/wiki/index.php/Meteorology/Everyday_Weather ◆ Weather Map Gallery Walk Forecast sheet ◆ Teacher Prep: Recording of weather forecast from your local news station to share with class	◆ Ask students, "How do scientists gather data about weather?" Listen for students to respond with names of instruments. ◆ Explain that weather is different all over and that people rely on meteorologists or forecasters to inform people about the weather in their area at a certain time and day. State how meteorologists collect and analyze data on weather patterns and changes, and explain how present weather symbols tell predicted weather for a particular area. ◆ Introduce weather symbols chart. ◆ Tell students that these symbols represent specific and current weather happening in an area and possible incoming weather. ◆ Display a weather forecast from the local news channel. Discuss the information the reporter focused on. ◆ Reiterate to students that forecasters use maps to display current weather in the area and provide us with forecasts that are weather predictions based on the data they collect using weather instruments. ◆ Tell the students they will be exploring a variety of weather maps of the United States on the same day by participating in a Gallery Walk around the room.	◆ Explain to students how the groups will rotate and have a student model how movement around the room should look to allow for smooth transitions from map to map. It is suggested that you use a signal to rotate. ◆ Teacher should circulate throughout the Gallery Walk activity asking questions regarding the symbols and what they tell us. ◆ Number the maps to correspond with the data the students will record on the Gallery Walk Forecast Sheet. Students can complete the forecast sheet individually or one per group. ◆ Remind students that they should look at only one state on all of the weather maps.

ENRICH CONT'D

♦ **Gallery Walk**—Students rotate in small groups through the gallery of weather maps, either placed at stations or hung around the room. The students use their weather symbols chart to help them decipher the weather.

♦ At each weather map, they examine the map, identify weather occurrences at particular places by using their weather symbols chart, and predict types of weather systems for their state or a state of their choosing on their weather map Gallery Walk forecast sheet.

♦ After all groups have rotated through the gallery of weather maps, have students write a forecast and share with the class. Initiate a discussion with the following questions:
Why is having an accurate report important to people? Let's think about what you are wearing today. Did knowing the weather impact your decision on how you dressed today? Are forecasts always accurate? Why or why not?
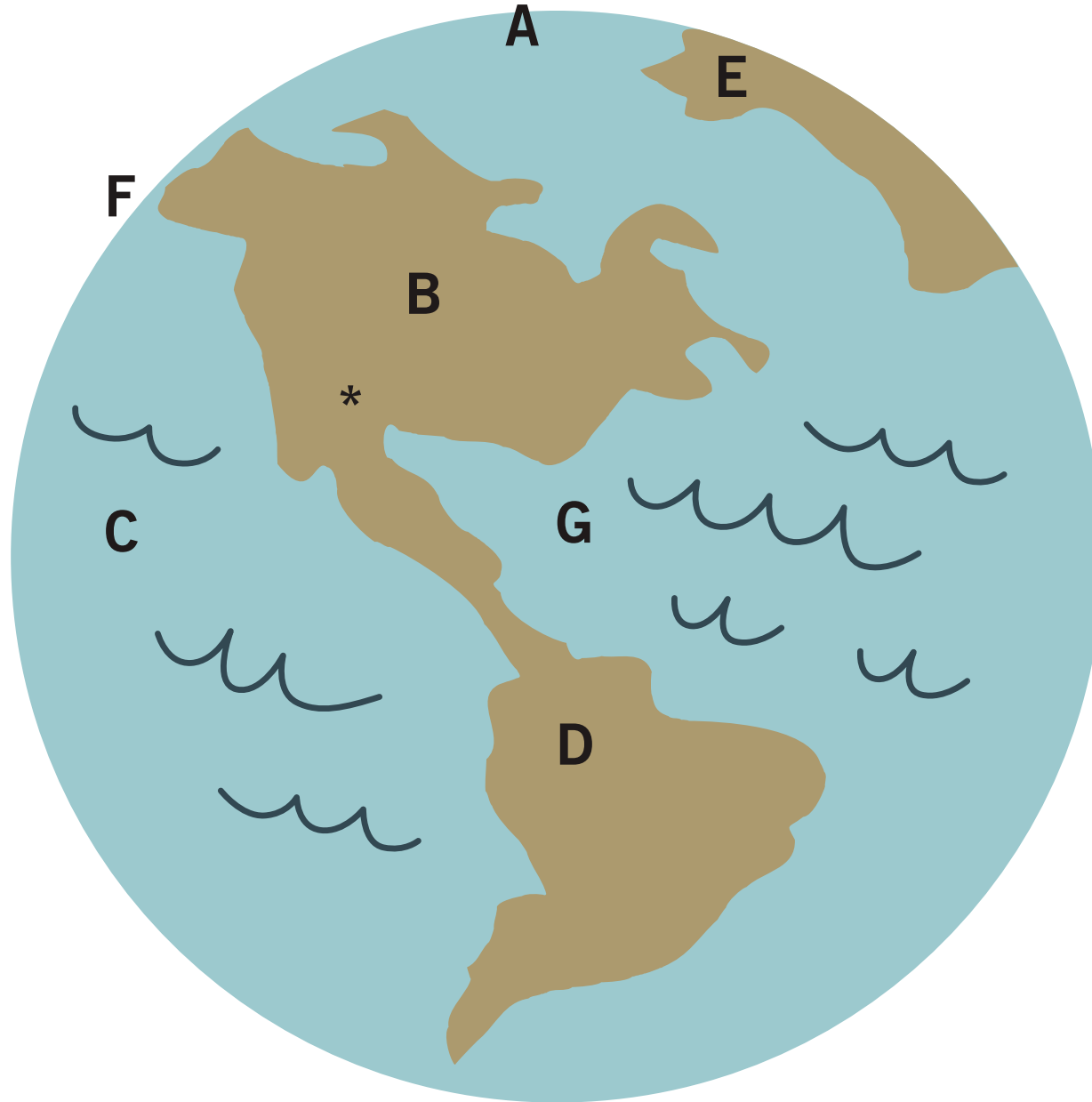
EVALUATION

Options 1: Weather Map Gallery Walk Forecast Sheet

Option 2: Public Service Announcement and Weather Survival Kit

NAME: _____

GALLERY WALK FORECAST SHEET

Choose one state to observe on all of the weather maps in the Gallery Walk. Circulate to all of the weather maps and make some observations about the weather in your chosen state to include in a weather forecast. Use the Weather Symbols Chart to help you.

What state did your group choose? _____

Map # _____ **Map Title** _____

What observations did you make for your chosen state?

_____

_____

_____

_____

Map # _____ **Map Title** _____

What observations did you make for your chosen state?

_____

_____

_____

_____

Map # _____ **Map Title** _____

What observations did you make for your chosen state?

_____

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_____

Map # _____ **Map Title** _____

What observations did you make for your chosen state?

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_____

_____

Map # _____ **Map Title** _____

What observations did you make for your chosen state?

_____

_____

_____

_____

AMAZON ORIGINAL
THE
AERONAUTS

AMAZON STUDIOS

sharemylesson
By Educators, For Educators
Created by the AFT Science Cadre

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Map # _____ **Map Title** _____

What observations did you make for your chosen state?

_____

_____

_____

_____

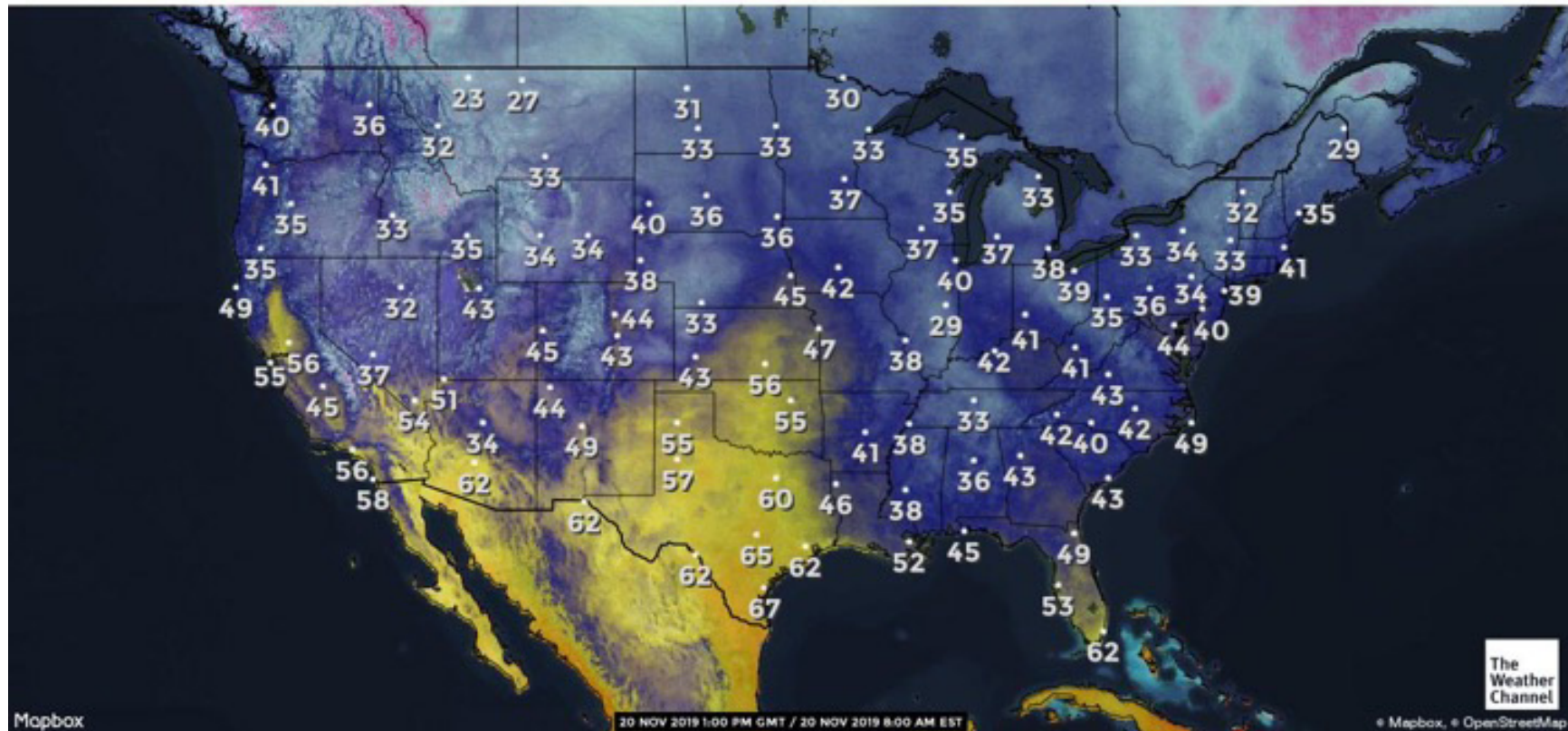Use the information your group collected to write a weather forecast for your state to share with the class.

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— 3 —

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https://weather.com/maps/usprecipitationforecast

CURRENT TEMPERATURES (°F)

NOV 20, 2019

https://weather.com/maps

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aft | sharemylesson
By Educators, For Educators
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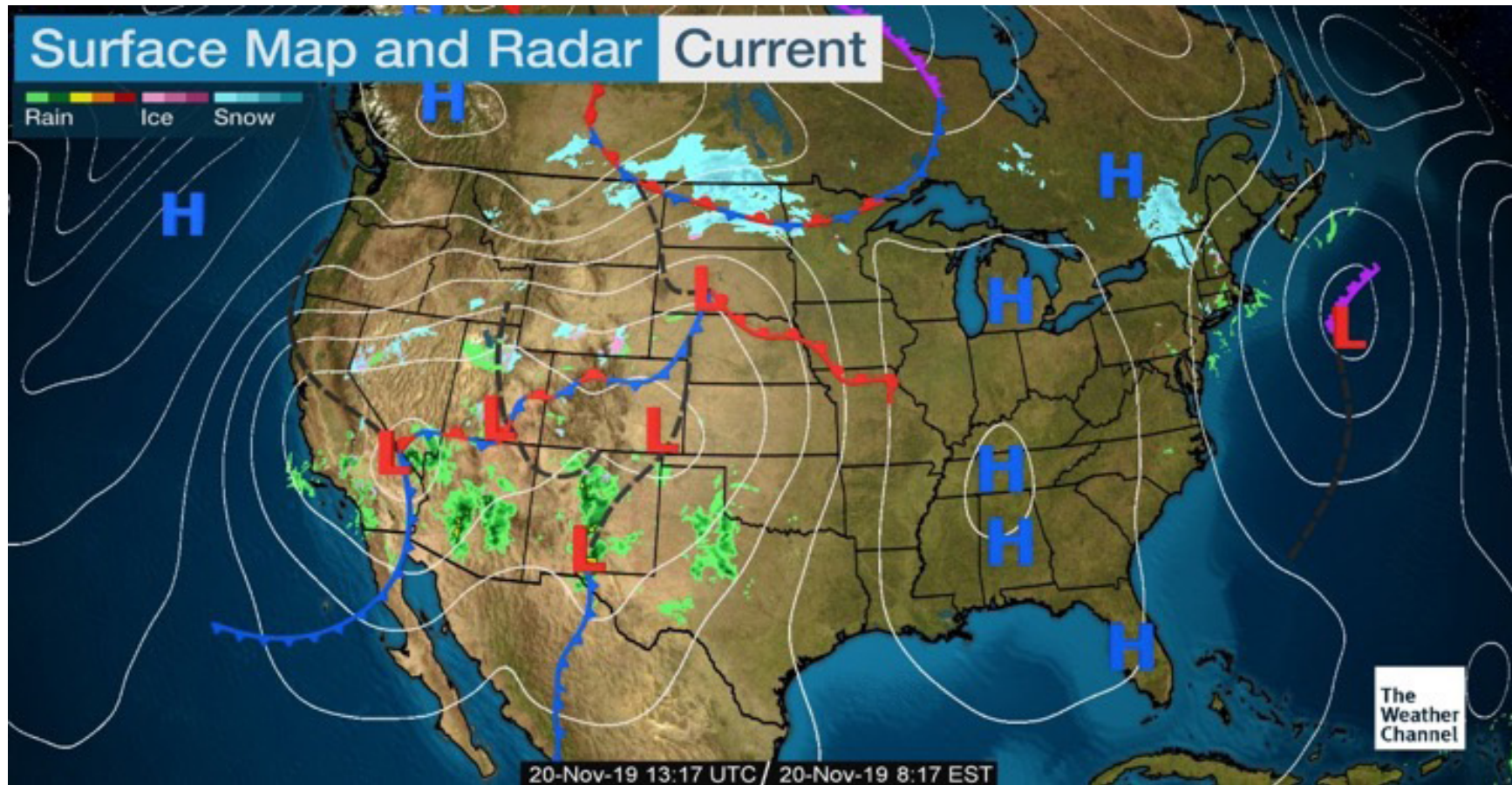
CURRENT DEW POINTS (°F)   NOV 20, 2019

DRY   0°   10°   20°   30°   40°   50°   60°   70°   80°   HUMID

THE AERONAUTS
AMAZON ORIGINAL

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By Educators, For Educators
Created by the AFT Science Cadre
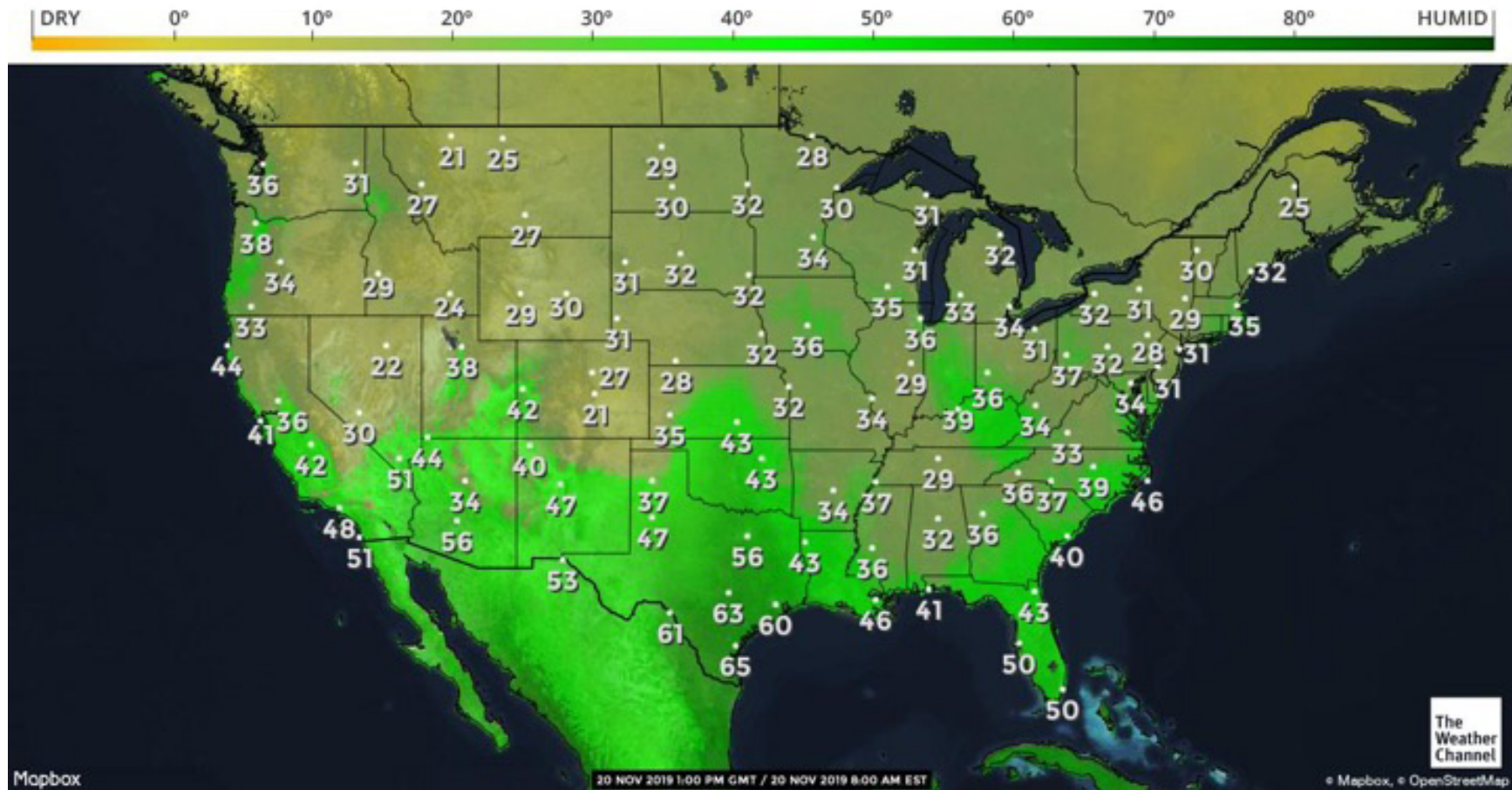
THURSDAY FORECAST — NOV 21, 2019

-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120

Seattle 50°
Cut Bank 33°
Minot 30°
International Falls 26°
Sault Ste. Marie 40°
Caribou 31°
Billings 37°
Minneapolis 38°
Boston 50°
Boise 45°
Rapid City 34°
Detroit 49°
Buffalo 47°
New York 55°
Medford 58°
Salt Lake City 47°
Kansas City 54°
Chicago 55°
Reno 49°
Denver 35°
St. Louis 65°
Cincinnati 58°
Washington 54°
San Francisco 62°
Las Vegas 55°
Albuquerque 46°
Oklahoma City 60°
Norfolk 54°
Los Angeles 65°
Phoenix 62°
Lubbock 53°
Dallas 73°
Memphis 64°
Atlanta 65°
Charlotte 61°
El Paso 61°
Houston 79°
New Orleans 76°
Jacksonville 71°
San Antonio 77°
Tampa 78°
Brownsville 83°
Miami 77°

20 NOV 2019 1:00 PM GMT / 20 NOV 2019 8:00 AM EST

The Weather Channel

Mapbox © Mapbox, © OpenStreetMap

CURRENT WIND SPEEDS - GUSTS INDICATED

WEDNESDAY NOV 20, 2019

| 10 MPH | 20 MPH | 30+ MPH |

https://weather.com/maps
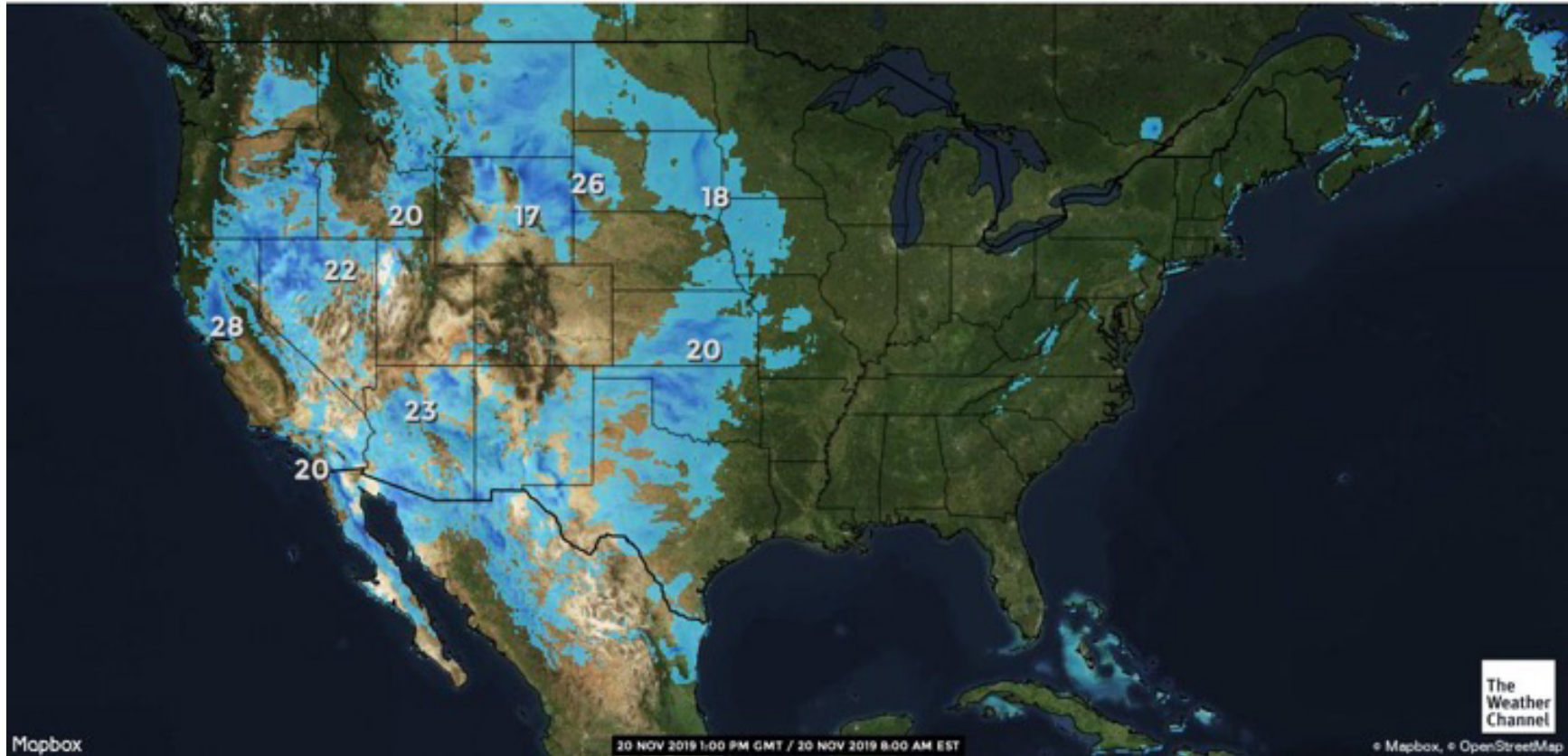
NAME: _____

L Low Pressure Center in Millibars... typically brings clouds and precipitation

H High Pressure Center in Millibars... typically brings clouds and precipitation

Unshaded areas indicate cloud-free or fair skies →

← Grey shaded areas indicate cloudy areas

Black lines are lines of constant pressure or isobars →

← Green shaded areas indicate areas that have the best chance for precipitation

988

Symbol	Label	Symbol	Label
••	Rain	≡	Fog
•••	Moderate Rain	≣	Dense Fog
••••	Heavy Rain	••≡	Rain and Fog
•,•	Rain and Drizzle	,,≡	Drizzle and Fog
,,	Drizzle	•,,≡	Rain, Drizzle & Fog
•❄	Rain and Snow	❄≡	Snow and Fog
❄❄	Flurries	•❄≡	Rain, Snow & Fog
❄❄❄	Snow	~	Freezing Rain
❄❄❄	Moderate Snow	~	Freezing Drizzle
ʃ	Smoke	✦	Blowing Snow
℞	Thunderstorms	℞	Thunderstorms w/ Hail

Rain Showers

Snow Showers

Rain & Snow Showers

Snow or Ice Pellets

Cold Front...boundary between approaching cold air and warmer air ↓

Warm Front... boundary between approaching warm air and cooler air ←

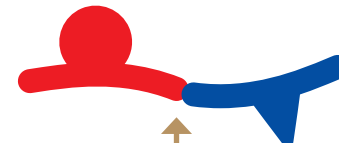Occluded Front... cold air over takes warm air or vice versa ←

Trough...boundary of low pressure ↑

Stationary Front...boundary between warm and cold air has little or no movement ↑
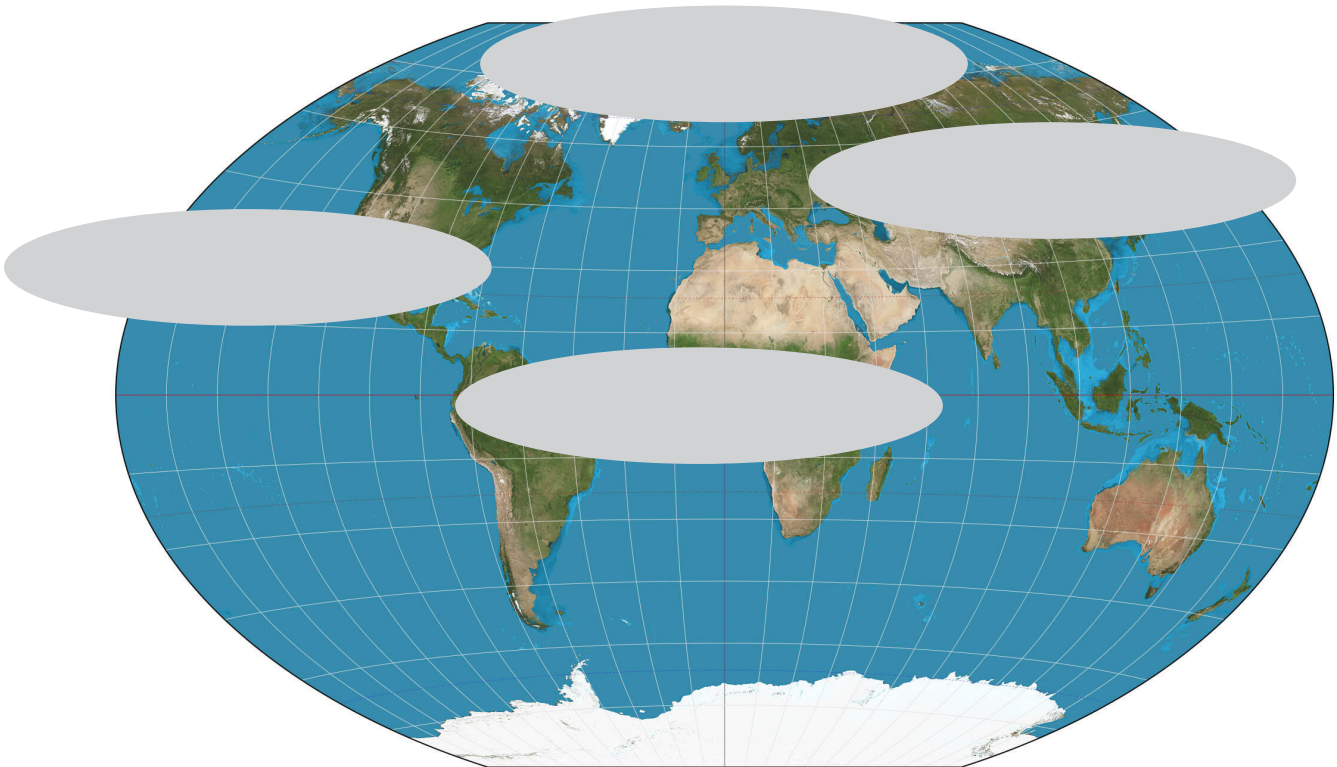
NAME: _____

MODIFIED NOTES

AIR MASSES

An air mass is a _____ body of air that has similar _____ and _____ .

Air Mass	Origin	Name

Maritime Polar _____
_____

Maritime Tropical _____
_____

Continental Polar _____
_____

Continental Tropical _____
_____

What is a front?

_____
_____

Describe the following fronts:

Cold front _____
_____

Warm front _____
_____

Stationary front _____
_____

Occluded front _____
_____

On the weather map, what does the L represent?

_____

_____

What does the H represent?

_____

_____

In addition to the point of origin, what else can affect air masses and weather?

_____

_____

How could the gyres affect an air mass?

_____

_____

In simple terms, the _____ makes things (like planes or currents of air) traveling long distances

around the Earth appear to move at a _____ line as opposed to a _____ line.

Air masses tend to flow from areas of _____ pressure to _____ pressure.

In the Northern Hemisphere, weather systems generally blow from the _____ to the

_____ .