NORTH CAROLINA GRADE 7 SCIENCE

Weather Lab NC

Student Notes & Investigation Workbook

Name ____________________ • Class __________ • Teacher ____________________

30 DAYS • FIVE UNITS • ESS.7.1 + ESS.7.2

How to use this workbook

Read each short note section, underline cause-and-effect words, circle unfamiliar vocabulary, and add an example or diagram in the space provided. Complete the evidence checks before opening the sample responses on the website. Use the practice challenge to retrieve the idea without copying from the notes.

My science routine: Observe → Describe evidence → Explain relationships → Predict → Revise

Course concept map: before learning

Draw or write what you think connects the Sun, atmosphere, water, wind, clouds, weather maps, climate, and safety. Return to this map on Day 30.

UNIT 1 • DAY 1 • ESS.7.1.4

Weather Detectives

I can: I can distinguish weather from climate and identify evidence meteorologists collect.
Essential question: How can a short observation become useful scientific evidence?

Words to know

weather • climate • atmosphere • observation • variable • pattern

1. Weather is now; climate is a pattern

Weather describes atmospheric conditions at a particular place and time. Temperature, precipitation, wind, cloud cover, humidity, and air pressure can all change within hours. Climate describes the usual range and long-term patterns of weather for a region. One hot afternoon is weather; many decades of temperature records help describe climate.

Capture the idea in a phrase, sketch, or example:

2. Meteorologists measure variables

A useful observation includes a variable, a number or description, a unit, a place, and a time. Thermometers measure air temperature, barometers measure pressure, anemometers measure wind speed, wind vanes show direction, rain gauges measure precipitation, and hygrometers estimate humidity. Repeated measurements reveal change and patterns.

Capture the idea in a phrase, sketch, or example:

3. Evidence supports a forecast

A forecast is not a guess. Meteorologists compare current observations with earlier conditions, maps, radar, satellites, and computer models. A claim about tomorrow's weather is stronger when several sources of evidence agree.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A single unusual day does not prove that a region's climate has changed.

Evidence check

1. **Why is 'It feels bad outside' weak scientific evidence?**

2. **Give one difference between weather and climate.**

Investigation record

Evidence or opinion? Students examine six weather statements, underline measurable evidence, and revise weak statements into scientific observations.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which statement describes climate?

A. Raleigh received rain at 3 p.m.

B. Boone usually has cooler winters than Wilmington

C. Wind speed increased during lunch

D. A thunderstorm warning expires tonight

Exit ticket

Name two measurements that would help predict whether a storm is approaching.

UNIT 1 • DAY 2 • ESS.7.1.1

What Is Air Made Of?

I can: I can interpret a model of atmospheric gases and explain why trace gases matter.
Essential question: How can a gas present in a tiny amount have a large effect?

Words to know

mixture • nitrogen • oxygen • argon • water vapor • trace gas

1. Air is a mixture

Dry air near Earth's surface is about 78 percent nitrogen, 21 percent oxygen, and almost 1 percent argon. Carbon dioxide and other gases occur in much smaller amounts. A mixture keeps the properties of its parts; the gases are not joined into one new substance.

Capture the idea in a phrase, sketch, or example:

2. Water vapor changes

Water vapor commonly ranges from nearly 0 to about 4 percent of air. Warm tropical air can contain much more water vapor than cold, dry polar air. Water vapor provides material for clouds and precipitation and is also a greenhouse gas.

Capture the idea in a phrase, sketch, or example:

3. Small does not mean unimportant

Ozone blocks much harmful ultraviolet radiation in the stratosphere. Carbon dioxide, methane, and water vapor absorb some outgoing infrared energy. Scientists monitor these trace gases because changes in atmospheric composition can affect living things and Earth's energy balance.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Oxygen is not the most abundant atmospheric gas; nitrogen is.

Evidence check

1. **What percentage of dry air is nitrogen plus oxygen?**

2. **Why might two air samples have different water-vapor percentages?**

Investigation record

Groups build a 100-particle model of dry air, then critique what the model shows well and what it cannot show, including variable water vapor and tiny trace-gas amounts.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match each atmospheric component to its best description.

A. absorbs harmful ultraviolet radiation

B. variable gas connected to clouds

C. about one fifth of dry air

D. largest part of dry air

_____ 1. Nitrogen

_____ 2. Oxygen

_____ 3. Water vapor

_____ 4. Ozone

Exit ticket

Explain why a trace gas can still influence Earth systems.

UNIT 1 • DAY 3 • ESS.7.1.1

Layers of the Atmosphere

I can: I can compare atmospheric layers using altitude, temperature, pressure, and defining features.
Essential question: Why does atmospheric temperature not change in one simple direction?

Words to know

troposphere • stratosphere • mesosphere • thermosphere • altitude • temperature profile

1. Layers are identified by temperature trends

From the surface upward, the main layers are troposphere, stratosphere, mesosphere, and thermosphere. Scientists use changes in the direction of the temperature trend to mark boundaries. Temperature decreases through the troposphere, increases in the stratosphere, decreases in the mesosphere, and increases sharply in the thermosphere.

Capture the idea in a phrase, sketch, or example:

2. Weather stays low

The troposphere contains most atmospheric mass and nearly all clouds and weather. It is heated mainly from below as Earth's surface absorbs sunlight and transfers energy to the air. The stratosphere warms upward because ozone absorbs ultraviolet radiation.

Capture the idea in a phrase, sketch, or example:

3. Pressure and density decrease upward

Gravity pulls gas particles toward Earth, so more air is packed near the surface. As altitude increases, there are fewer particles above and around you. Air pressure and density generally decrease with altitude in every layer, even when temperature rises.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: The thermosphere can have a high particle temperature but would not feel hot because its particles are extremely spread out.

Evidence check

1. **Which variable consistently decreases with altitude?**

2. **Why does the stratosphere warm upward?**

Investigation record

Students annotate a simplified altitude-temperature graph, order the layer cards, and attach feature cards such as weather, ozone, meteors, and auroras.

Evidence I collected:

What the evidence means:

Practice challenge

1. Arrange the layers from Earth's surface upward.

_____ Thermosphere

_____ Mesosphere

_____ Stratosphere

_____ Troposphere

Exit ticket

Identify the atmospheric layer where weather occurs and give one reason.

UNIT 1 • DAY 4 • ESS.7.1.1, ESS.7.1.4

Air Pressure and Weather Tools

I can: I can explain air pressure and select appropriate weather instruments.
Essential question: How can invisible air push on objects and signal changing weather?

Words to know

air pressure • barometer • anemometer • wind vane • hygrometer • millibar

1. Air has mass and pressure

Gas particles collide with surfaces and exert force. Air pressure is the force of air spread over an area. Near sea level, a typical pressure is about 1013 millibars, but it changes with altitude and weather systems.

Capture the idea in a phrase, sketch, or example:

2. Pressure trends are evidence

A rising barometer often accompanies approaching or strengthening high pressure and more stable conditions. Falling pressure can signal an approaching low-pressure system and increasing chances of clouds, wind, or precipitation. Pressure alone is not enough; meteorologists combine it with other evidence.

Capture the idea in a phrase, sketch, or example:

3. Tools answer different questions

A thermometer measures temperature, a barometer measures pressure, a hygrometer measures humidity, an anemometer measures wind speed, a wind vane shows the direction wind comes from, and a rain gauge measures liquid precipitation depth.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A north wind comes from the north; it does not blow toward the north.

Evidence check

1. **Which tool measures humidity?**

2. **What does a falling pressure trend suggest?**

Investigation record

At instrument stations, students match each tool to its variable and unit, then analyze a 12-hour pressure trend alongside cloud observations.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which observation is direct evidence that a low-pressure system may be approaching?

A. Barometer readings fall for six hours

B. The calendar changes to April

C. Yesterday was cloudy

D. A classmate predicts rain

Exit ticket

Which two instruments would best test whether conditions are becoming windier and stormier?

UNIT 1 • DAY 5 • ESS.7.1.1

Atmosphere Data Lab

I can: I can analyze atmospheric data to compare layers and make an evidence-based claim.
Essential question: What patterns in data reveal the structure of the atmosphere?

Words to know

data table • line graph • trend • claim • evidence • reasoning

1. Graphs make vertical patterns visible

An atmospheric profile places altitude on the vertical axis and a measured variable on the horizontal axis. Look first for overall direction, turning points, steep changes, and intervals that stay nearly constant.

Capture the idea in a phrase, sketch, or example:

2. Compare more than one variable

Temperature may reverse direction between layers, while pressure continues to decrease. Comparing two graphs prevents an incorrect claim based on one variable. A complete analysis names the interval and uses values or trends as evidence.

Capture the idea in a phrase, sketch, or example:

3. Scientific explanations connect evidence to a cause

A claim answers the question. Evidence comes from the data. Reasoning explains why the evidence supports the claim using a science idea, such as ozone absorbing ultraviolet energy or gravity concentrating air near the surface.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A line sloping upward on a profile does not always mean altitude is increasing; read both axes and units.

Evidence check

1. **Why should layer boundaries be placed near temperature turning points?**

2. **What happens to pressure across all four layers?**

Investigation record

Teams graph temperature and pressure versus altitude, infer layer boundaries, and write a claim-evidence-reasoning explanation.

Evidence I collected:

What the evidence means:

Practice challenge

1. A profile shows temperature decreasing, then increasing with altitude. What does the turning point most likely mark?

A. A layer boundary

B. Sea level

C. A rain gauge error

D. The end of gravity

Exit ticket

Write one pattern that applies to atmospheric pressure but not always temperature.

UNIT 2 • DAY 6 • ESS.7.1.2

Water Takes Many Paths

I can: I can model multiple pathways water follows through Earth's systems.
Essential question: Why is the water cycle a web of pathways rather than one circle?

Words to know

evaporation • transpiration • condensation • precipitation • runoff • infiltration

1. Water moves among reservoirs

Oceans, lakes, rivers, soil, groundwater, glaciers, living things, and the atmosphere store water for different lengths of time. Water can follow many paths. Rain may run to a stream, infiltrate soil, enter groundwater, be taken up by a plant, or evaporate.

Capture the idea in a phrase, sketch, or example:

2. Solar energy lifts; gravity pulls down

Energy from the Sun drives evaporation from surfaces and transpiration from plants. Rising moist air can cool, leading to condensation. Gravity causes precipitation to fall and moves runoff and groundwater downhill toward lower elevations and oceans.

Capture the idea in a phrase, sketch, or example:

3. Matter cycles but does not disappear

Water changes location and state while remaining water. A useful model includes reservoirs, processes, arrows showing direction, and energy or gravity labels. It should allow more than one possible path.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Water does not always travel through the cycle in the same order.

Evidence check

1. **What powers evaporation?**

2. **What force moves precipitation and runoff downhill?**

Investigation record

Students act as water molecules, use a spinner at each reservoir, record their path, and compare journeys before revising a water-cycle model.

Evidence I collected:

What the evidence means:

Practice challenge

1. Place one possible pathway in a logical order.

_____ Infiltration into soil

_____ Precipitation over land

_____ Cloud condensation

_____ Ocean evaporation

Exit ticket

Describe one path from ocean water to groundwater.

UNIT 2 • DAY 7 • ESS.7.1.2

Phase Changes and Energy

I can: I can explain whether water absorbs or releases energy during each phase change.
Essential question: How can water change state without changing identity?

Words to know

melting • freezing • vaporization • condensation • sublimation • deposition

1. Adding energy spreads particles

Melting, vaporization, and sublimation require water to absorb energy from the surroundings. Particle motion increases and attractions are overcome. Evaporation is vaporization from a liquid surface and can occur below the boiling point.

Capture the idea in a phrase, sketch, or example:

2. Removing energy brings particles together

Condensation, freezing, and deposition occur when water releases energy to the surroundings. Gas particles slow and form liquid droplets during condensation. Liquid particles organize into a solid during freezing.

Capture the idea in a phrase, sketch, or example:

3. Phase changes shape weather

Evaporation transfers water and energy into the atmosphere. Condensation forms cloud droplets and releases energy that can strengthen rising air. Freezing and melting influence precipitation type and surface conditions.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Cold does not flow into an object; thermal energy transfers from warmer matter to cooler matter.

Evidence check

1. **Does condensation absorb or release energy?**

2. **Why can evaporation cool a surface?**

Investigation record

Students model particle spacing and sort six phase changes by starting state, ending state, and direction of energy transfer.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match each phase change to its energy direction.

A. water releases energy

B. water absorbs energy

C. water releases energy

D. water absorbs energy

_____ 1. Evaporation

_____ 2. Condensation

_____ 3. Melting

_____ 4. Freezing

Exit ticket

Name one energy-absorbing and one energy-releasing phase change.

UNIT 2 • DAY 8 • ESS.7.1.2, ESS.7.1.4

Humidity, Dew Point, and Clouds

I can: I can use temperature and moisture evidence to explain condensation and cloud formation.
Essential question: What must happen before invisible water vapor becomes a visible cloud?

Words to know

humidity • relative humidity • dew point • saturation • condensation nucleus • cloud

1. Humidity describes water vapor

Relative humidity compares the amount of water vapor present with the maximum amount possible at that temperature. Warm air can be associated with a larger maximum amount than cool air. Relative humidity can rise because vapor is added or because air cools.

Capture the idea in a phrase, sketch, or example:

2. Dew point is a moisture clue

The dew point is the temperature to which air must cool to become saturated, assuming its water-vapor amount stays constant. When air temperature and dew point are close, relative humidity is high and condensation is more likely.

Capture the idea in a phrase, sketch, or example:

3. Clouds require cooling and particles

Air commonly rises and expands as surrounding pressure decreases. Expansion cools the air. At saturation, water vapor condenses on tiny particles called condensation nuclei, forming cloud droplets or ice crystals.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Air does not act like a rigid container that 'holds' water; temperature changes the balance between evaporation and condensation.

Evidence check

1. **Which is more humid: 24 C air with a 23 C dew point or 24 C air with a 10 C dew point?**

2. **Why does rising air often cool?**

Investigation record

Pairs compare air temperature and dew point across scenarios, rank condensation likelihood, and model rising air cooling to form a cloud.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which change most directly raises relative humidity if water vapor stays constant?

A. Air cools toward its dew point

B. Air pressure rises slightly

C. Wind changes direction

D. Sunlight becomes brighter

Exit ticket

List the steps from rising moist air to a visible cloud.

UNIT 2 • DAY 9 • ESS.7.1.2, ESS.7.1.4

Clouds and Precipitation

I can: I can connect cloud form and atmospheric motion to likely weather.
Essential question: What can a cloud's shape and altitude reveal about moving air?

Words to know

cumulus • stratus • cirrus • cumulonimbus • coalescence • precipitation

1. Cloud names describe form and height

Cumulus clouds are puffy and linked to rising parcels. Stratus clouds form broad layers. Cirrus clouds are high and icy. Prefixes add clues: alto indicates middle levels, nimbo or nimbus indicates precipitation, and cumulo indicates vertical development.

Capture the idea in a phrase, sketch, or example:

2. Droplets must grow

Cloud droplets are usually too small to fall as precipitation. In warmer clouds, droplets collide and combine through coalescence. In cold clouds, ice crystals can grow while nearby droplets evaporate. Falling particles may melt, freeze, or remain frozen depending on the temperature profile.

Capture the idea in a phrase, sketch, or example:

3. Clouds are forecast evidence

Fair-weather cumulus may indicate limited convection. Growing towering cumulus can warn of increasing instability. Cumulonimbus clouds can produce heavy rain, lightning, hail, strong winds, and sometimes tornadoes. Layered clouds commonly accompany gradual lifting near warm fronts.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Clouds are not made of invisible water vapor; they are visible droplets and/or ice crystals.

Evidence check

1. **Which cloud shows the greatest vertical development?**

2. **Why can a cloud exist without precipitation reaching the ground?**

Investigation record

Teams classify cloud cards by form, altitude, and likely vertical motion, then use vertical temperature profiles to predict rain, snow, sleet, or freezing rain.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match the cloud to the strongest clue.

A. deep thunderstorm cloud

B. puffy rising-air cloud

C. broad low layer

D. high, thin ice clouds

_____ 1. Cirrus

_____ 2. Stratus

_____ 3. Cumulus

_____ 4. Cumulonimbus

Exit ticket

What cloud change would make you more concerned about thunderstorms?

UNIT 2 • DAY 10 • ESS.7.1.2

Water-Cycle Systems Model

I can: I can create and evaluate a model that links solar energy, gravity, phase changes, and weather.
Essential question: What makes a water-cycle model scientifically useful?

Words to know

system • reservoir • process • driver • feedback • model limitation

1. A strong model shows relationships

A useful system model names reservoirs, labels processes on arrows, identifies state changes, and shows where solar energy or gravity drives movement. It should display several possible pathways rather than one fixed loop.

Capture the idea in a phrase, sketch, or example:

2. Models explain and predict

A model should help answer a question. For example, increasing solar heating may increase evaporation if water is available. Cooling moist air to its dew point increases condensation. Steep slopes and saturated soil may increase runoff.

Capture the idea in a phrase, sketch, or example:

3. Every model has limits

A diagram may not show rate, scale, storage time, groundwater complexity, or changing human influences. Naming limitations is a strength because it shows what evidence would be needed to improve the model.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A more colorful or complicated model is not automatically a more accurate explanatory model.

Evidence check

1. **Where should solar energy appear in the model?**

2. **Where should gravity appear?**

Investigation record

Students build a model explaining how warm Atlantic water can contribute moisture to a North Carolina rain event, then critique another model using a checklist.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which addition most improves a basic water-cycle diagram as an explanatory model?

A. Label energy from the Sun and gravity on relevant pathways

B. Use more colors without labels

C. Draw every arrow in a circle

D. Remove groundwater to make it simpler

Exit ticket

Name one required feature and one limitation of your model.

UNIT 3 • DAY 11 • ESS.7.1.5

Uneven Heating and Convection

I can: I can model how uneven surface heating creates convection in air.
Essential question: How does unequal solar heating begin the motion we call wind?

Words to know

radiation • absorption • conduction • convection • density • buoyancy

1. The surface heats unevenly

Sunlight reaches Earth by radiation. Dark soil, vegetation, pavement, water, and clouds absorb and reflect different amounts. Sun angle also varies by latitude, season, and time of day. These differences create temperature contrasts.

Capture the idea in a phrase, sketch, or example:

2. Warm air becomes less dense

Air touching a warm surface gains energy by conduction. Its particles move faster and spread out, lowering density. In surrounding cooler, denser air, the warmer parcel experiences an upward buoyant force. Cooler air moves in to replace it.

Capture the idea in a phrase, sketch, or example:

3. Convection transfers energy

The repeating movement of warmer fluid rising and cooler fluid sinking is convection. Atmospheric convection can produce local winds, build clouds, and redistribute thermal energy. The cycle continues while an energy difference remains.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Heat does not automatically rise; warmer, less-dense fluid can rise within a denser surrounding fluid.

Evidence check

1. **Why is warmer air often less dense?**

2. **What maintains a convection current?**

Investigation record

Groups compare temperature change above two surfaces under equal illumination, then use a particle model to explain resulting convection.

Evidence I collected:

What the evidence means:

Practice challenge

1. Order the events in an atmospheric convection current.

_____ Warm air rises as cooler air moves in
_____ Air expands and becomes less dense
_____ Surface warms nearby air
_____ Surface absorbs solar energy

Exit ticket

Explain convection using energy, particle spacing, and density.

UNIT 3 • DAY 12 • ESS.7.1.5

Pressure Gradients and Local Winds

I can: I can explain how pressure differences drive wind and reverse local breezes.
Essential question: Why can a coastal breeze change direction after sunset?

Words to know

wind • pressure gradient • sea breeze • land breeze • upslope wind • downslope wind

1. Wind responds to pressure differences

Air accelerates from areas of relatively higher pressure toward areas of relatively lower pressure. A larger pressure change across the same distance is a stronger pressure gradient and can produce faster wind. Friction and Earth's rotation modify the path.

Capture the idea in a phrase, sketch, or example:

2. Land and water heat at different rates

During a sunny day, land usually warms faster than nearby water. Air over land warms and rises, creating relatively lower surface pressure; cooler air moves inland from over the water as a sea breeze. At night, land cools faster, and the near-surface flow can reverse as a land breeze.

Capture the idea in a phrase, sketch, or example:

3. Mountains create daily wind patterns

Sunny mountain slopes warm air during the day, encouraging upslope flow. At night, slope air cools, becomes denser, and drains downhill. North Carolina terrain can also channel and redirect larger weather-system winds.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Wind is named for the direction it comes from, and surface wind does not move in a perfectly straight path from high to low pressure.

Evidence check

1. **What causes the surface sea breeze during the day?**

2. **What does a strong pressure gradient suggest?**

Investigation record

Students arrange surface-temperature, rising/sinking-air, pressure, and wind arrows on day and night coastal models.

Evidence I collected:

What the evidence means:

Practice challenge

1. At noon the land is much warmer than the ocean. Which near-surface wind is most likely?

A. From ocean toward land

B. From land toward ocean

C. Straight upward over the ocean only

D. No wind can occur near water

Exit ticket

Draw or describe the daytime surface wind direction at a beach.

UNIT 3 • DAY 13 • ESS.7.1.5

Earth's Rotation and Global Flow

I can: I can use a model to explain why global winds curve and form circulation cells.
Essential question: Why does moving air follow curved global paths?

Words to know

global circulation • Coriolis effect • Hadley cell • Ferrel cell • polar cell • deflection

1. Unequal heating drives global circulation

The equator receives more concentrated solar energy than the poles. Warm air tends to rise in low latitudes, move through the upper atmosphere, cool, and sink elsewhere. This creates large circulation cells that transfer energy poleward.

Capture the idea in a phrase, sketch, or example:

2. Rotation changes the apparent path

Earth rotates beneath moving air. From Earth's surface, long-distance motion appears deflected to the right in the Northern Hemisphere and left in the Southern Hemisphere. This is the Coriolis effect. It changes direction, not the original source of wind energy.

Capture the idea in a phrase, sketch, or example:

3. Three-cell model

A simplified hemisphere contains a Hadley cell from 0 to 30 degrees, a Ferrel cell from 30 to 60 degrees, and a polar cell from 60 to 90 degrees. Real circulation shifts with seasons, continents, oceans, and weather systems.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: The Coriolis effect does not control water draining from ordinary sinks; it matters for large-scale, long-duration motion.

Evidence check

1. **What starts global atmospheric circulation?**

2. **Which way is large-scale motion deflected in the Northern Hemisphere?**

Investigation record

Students draw a path on rotating and stationary disks, then build a simplified Northern Hemisphere circulation-cell model.

Evidence I collected:

What the evidence means:

Practice challenge

1. What is the best description of the Coriolis effect?

A. Apparent deflection of long-distance motion because Earth rotates

B. Warm air always moving north

C. Gravity pulling clouds downward

D. Friction stopping all upper-air wind

Exit ticket

Separate the roles of unequal heating and rotation in global wind.

UNIT 3 • DAY 14 • ESS.7.1.5

Global Wind Belts

I can: I can connect global circulation cells to prevailing wind belts and climate patterns.
Essential question: How can prevailing winds help explain wet and dry climate zones?

Words to know

trade winds • westerlies • polar easterlies • doldrums • subtropical high • prevailing wind

1. Wind belts have prevailing directions

Near the surface, trade winds occur in the tropics, westerlies dominate much of the midlatitudes, and polar easterlies occur closer to the poles. These names describe the direction winds usually come from, not an unchanging daily wind.

Capture the idea in a phrase, sketch, or example:

2. Rising and sinking zones affect rainfall

Persistent rising air near the equator cools and condenses, supporting frequent clouds and precipitation. Sinking air near about 30 degrees latitude warms and dries, contributing to many desert regions. Other rising and sinking zones occur near 60 degrees and the poles.

Capture the idea in a phrase, sketch, or example:

3. North Carolina lies in the westerlies

Midlatitude systems across the United States often move generally west to east, influenced by prevailing westerlies and the jet stream. Local terrain, fronts, and pressure systems still control the weather experienced on a specific day.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A prevailing wind is a long-term dominant pattern, not a promise that the wind always blows that way.

Evidence check

1. **Which wind belt influences North Carolina most?**

2. **Why are many deserts near 30 degrees latitude?**

Investigation record

Students label circulation cells, pressure belts, prevailing surface winds, and expected wet/dry zones on a global map.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match each belt or zone to its location or behavior.

A. rising moist air near 0 degrees

B. sinking air near 30 degrees

C. midlatitude prevailing winds

D. tropical surface winds

_____ 1. Trade winds

_____ 2. Westerlies

_____ 3. Subtropical high

_____ 4. Equatorial low

Exit ticket

How can sinking air discourage cloud formation?

UNIT 3 • DAY 15 • ESS.7.1.5

The Jet Stream

I can: I can explain how temperature contrasts shape the jet stream and steer weather systems.
Essential question: Why can a narrow river of fast air change weather far below it?

Words to know

jet stream • upper atmosphere • temperature gradient • ridge • trough • storm track

1. Jet streams are fast upper-air currents

Jet streams are relatively narrow bands of strong wind near the top of the troposphere. They generally flow west to east but form waves. Strong temperature differences across a boundary can support a stronger jet.

Capture the idea in a phrase, sketch, or example:

2. Ridges and troughs redirect air

A northward bulge is commonly called a ridge and is often associated with warmer air beneath it. A southward dip is a trough and often brings cooler air farther south. The pattern can move, deepen, weaken, or stall.

Capture the idea in a phrase, sketch, or example:

3. The jet helps steer systems

Surface lows, fronts, and storm tracks are influenced by upper-level winds. Meteorologists use satellite water-vapor imagery and upper-air observations to locate the jet stream. A system separated from the main flow may move slowly, increasing the chance of prolonged heat or rain.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: The jet stream is not a solid tube and does not stay in one fixed position.

Evidence check

1. **What creates or strengthens major jet-stream temperature gradients?**

2. **How can a stalled upper-air pattern affect hazards?**

Investigation record

Groups trace jet-stream patterns, identify ridges and troughs, and predict which cities are likely to experience warmer, cooler, or stormier conditions.

Evidence I collected:

What the evidence means:

Practice challenge

1. A deep jet-stream trough moves over the eastern United States. Which change is most plausible?

A. Cooler air is carried farther south

B. All winds stop

C. Humidity becomes exactly zero

D. The atmosphere loses nitrogen

Exit ticket

Explain one way the jet stream influences North Carolina weather.

UNIT 3 • DAY 16 • ESS.7.1.5

Convection-to-Jet Model Checkpoint

I can: I can build a connected model from unequal heating to regional weather.
Essential question: How do small particle-level differences contribute to planet-scale patterns?

Words to know

scale • cause and effect • energy transfer • circulation • model • prediction

1. Causes connect across scales

Solar-energy differences change surface temperature. Surface temperature affects nearby air-particle motion and density. Density and pressure differences create convection and wind. Rotation deflects large-scale motion, helping organize global wind belts and jet streams.

Capture the idea in a phrase, sketch, or example:

2. Models need directional links

A connected model uses arrows and cause-and-effect language: because, therefore, increases, decreases, rises, sinks, and deflects. Each arrow should be explainable. Avoid linking terms only because they appeared in the same chapter.

Capture the idea in a phrase, sketch, or example:

3. Predictions test a model

If a surface temperature contrast becomes larger, a model may predict a stronger pressure gradient or circulation. Evidence can support, refine, or challenge the prediction. A model is revised when evidence does not fit.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Global circulation is not caused by one factor alone; heating, gravity, rotation, pressure differences, friction, land, and water interact.

Evidence check

1. **Where does the energy driving most atmospheric circulation originate?**

2. **What role does Earth rotation play?**

Investigation record

Teams connect concept cards from solar radiation through convection and global circulation to a North Carolina weather pattern.

Evidence I collected:

What the evidence means:

Practice challenge

1. Arrange the causal chain from energy source to large-scale pattern.

_____ Global winds shaped by rotation

_____ Convection and pressure-driven wind

_____ Temperature and density differences

_____ Unequal solar heating

Exit ticket

Write one four-step cause-and-effect chain from sunlight to wind.

UNIT 4 • DAY 17 • ESS.7.1.3

Air Masses

I can: I can classify air masses by source region and predict their temperature and moisture.
Essential question: How does an air mass carry the memory of where it formed?

Words to know

air mass • source region • continental • maritime • tropical • polar

1. Air masses form over broad, uniform regions

When air remains over a large land or water area, it can take on that surface's temperature and moisture characteristics. The first letter identifies moisture: continental (c) is dry and maritime (m) is moist. The second identifies temperature: tropical (T) is warm and polar (P) is cold.

Capture the idea in a phrase, sketch, or example:

2. Four common air masses affect the United States

Continental polar (cP) is cold and dry; maritime polar (mP) is cool and moist; continental tropical (cT) is hot and dry; maritime tropical (mT) is warm and moist. Arctic air can be even colder and drier.

Capture the idea in a phrase, sketch, or example:

3. Air masses change as they travel

An air mass can be modified by the surface below. Cold dry air moving across warm ocean water gains heat and moisture. Forecasts must consider both source characteristics and the path the air mass has traveled.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: The letters in an air-mass name describe its source characteristics, not a permanent unchanging property.

Evidence check

1. **What does mT mean?**

2. **Which air mass often brings cold dry winter air from Canada?**

Investigation record

Students place cP, mP, cT, and mT cards on source regions, then forecast their effects when each moves toward North Carolina.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match each air mass to its core properties.

A. warm and moist

B. hot and dry

C. cool and moist

D. cold and dry

_____ 1. cP

_____ 2. mP

_____ 3. cT

_____ 4. mT

Exit ticket

Classify warm, humid air arriving from the Gulf or western Atlantic.

UNIT 4 • DAY 18 • ESS.7.1.3

Cold and Warm Fronts

I can: I can compare frontal lifting and predict weather near cold and warm fronts.
Essential question: How does the slope of a front influence clouds and precipitation?

Words to know

front • cold front • warm front • frontal lifting • density • frontal passage

1. Fronts are air-mass boundaries

A front forms where air masses with different properties meet. Because cold air is denser, it tends to remain near the surface and force warmer air upward. Rising air can cool and condense into clouds and precipitation.

Capture the idea in a phrase, sketch, or example:

2. Cold fronts lift air quickly

At a cold front, advancing cold air undercuts warm air along a relatively steep boundary. Weather can include a narrow band of showers or thunderstorms, gusty shifting winds, a pressure change, and cooler or drier air after passage.

Capture the idea in a phrase, sketch, or example:

3. Warm fronts lift air gradually

At a warm front, warm air glides over retreating cool air along a gentle slope. Layered clouds and widespread steady precipitation may develop ahead of the surface front, followed by warmer air after passage.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A front is a three-dimensional sloping boundary, not only a colored line on a map.

Evidence check

1. **Why does warm air rise at a front?**

2. **Which front more often produces a narrow, intense line of weather?**

Investigation record

Pairs construct side-view models of cold and warm fronts and sequence before-during-after weather observations.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match the front to the typical clue.

A. warmer air often follows

B. cooler air often follows

C. gradual lift and widespread layered clouds

D. steep lift and narrow band of storms

_____ 1. Cold front

_____ 2. Warm front

_____ 3. Cold-front passage

_____ 4. Warm-front passage

Exit ticket

Compare lifting at a cold front and warm front.

UNIT 4 • DAY 19 • ESS.7.1.3

Stationary and Occluded Fronts

I can: I can explain stationary and occluded fronts and interpret their map symbols.
Essential question: What happens when a boundary stalls or one front catches another?

Words to know

stationary front • occluded front • cyclone • boundary • stall • occlusion

1. Stationary boundaries can prolong weather

A stationary front forms when neither air mass advances enough to replace the other. Winds often flow roughly parallel to the boundary. Clouds and precipitation can persist or repeat near a stalled front, increasing flood risk if moisture continues arriving.

Capture the idea in a phrase, sketch, or example:

2. Occlusion develops in a mature low

An occluded front forms when a faster cold front catches a warm front and lifts much of the warm air away from the surface. It commonly appears near a mature low-pressure system and can produce widespread clouds, wind, and precipitation.

Capture the idea in a phrase, sketch, or example:

3. Symbols show type and motion

Blue triangles mark a cold front and point toward its motion. Red semicircles mark a warm front. Alternating symbols on opposite sides show a stationary front; alternating symbols on the same side, usually purple, show an occluded front.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Stationary does not mean absolutely motionless; the boundary can wobble or begin moving later.

Evidence check

1. **How are stationary and occluded symbols different?**

2. **Why can a stationary front increase flood risk?**

Investigation record

Students identify fronts from symbols and use repeated rainfall observations to explain why a stalled boundary can create a hazard.

Evidence I collected:

What the evidence means:

Practice challenge

1. A boundary has red semicircles and blue triangles on opposite sides. What is it?

A. Stationary front

B. Cold front

C. Warm front

D. Occluded front

Exit ticket

Which front would you suspect if rain repeats near the same boundary for two days?

UNIT 4 • DAY 20 • ESS.7.1.3

Highs, Lows, and Midlatitude Systems

I can: I can use pressure patterns and front locations to explain likely weather.
Essential question: Why do low-pressure systems usually have more clouds than high-pressure systems?

Words to know

high pressure • low pressure • convergence • divergence • clockwise • counterclockwise

1. Surface lows encourage rising air

Near a Northern Hemisphere surface low, winds generally spiral inward counterclockwise. Converging air cannot pile up indefinitely, so it rises. Rising moist air expands, cools, and may form clouds and precipitation.

Capture the idea in a phrase, sketch, or example:

2. Surface highs encourage sinking air

Near a surface high, air generally sinks and spreads outward clockwise in the Northern Hemisphere. Sinking air compresses and warms, lowering relative humidity and often discouraging clouds. High pressure can still bring hazards such as heat, cold, drought, or poor air quality.

Capture the idea in a phrase, sketch, or example:

3. Fronts organize around lows

Midlatitude low-pressure systems often include warm, cold, and occluded fronts. The system commonly moves with upper-level winds. Weather changes as a location passes through different air masses and frontal zones.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: High pressure does not always mean pleasant weather, and low pressure does not guarantee severe weather.

Evidence check

1. **Why do clouds often form near lows?**

2. **How does surface air move around a Northern Hemisphere high?**

Investigation record

Students place wind arrows around highs and lows, add rising/sinking motion, and compare likely cloud and precipitation conditions at four locations.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which pattern best describes a Northern Hemisphere surface low?

A. Air spirals inward counterclockwise and rises

B. Air spirals outward clockwise and rises

C. Air stops moving

D. Air sinks straight down with no horizontal flow

Exit ticket

Compare vertical air motion and cloud likelihood in highs and lows.

UNIT 4 • DAY 21 • ESS.7.1.4

Weather Maps and Station Models

I can: I can decode a simplified station model and find patterns across a weather map.
Essential question: How can many small symbols tell the story of a large weather system?

Words to know

station model • isobar • pressure trend • wind barb • cloud cover • synoptic map

1. Station models compress observations

A station model places several observations around one location: temperature, dew point, pressure, cloud cover, wind direction and speed, and present weather. The wind staff points toward the direction the wind comes from. A simplified key is necessary to decode the symbols.

Capture the idea in a phrase, sketch, or example:

2. Isobars connect equal pressure

Isobars are lines connecting locations with the same air pressure. Closely spaced isobars show a stronger pressure gradient and often stronger wind. Closed contours can reveal high- and low-pressure centers.

Capture the idea in a phrase, sketch, or example:

3. Patterns reveal fronts

Meteorologists compare neighboring stations. A narrow zone with rapid temperature, dew-point, and wind-direction changes may mark a front. Pressure patterns and precipitation observations add supporting evidence.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: An isobar is not a path that wind must follow; it represents equal pressure.

Evidence check

1. **What do tightly packed isobars suggest?**

2. **What evidence besides temperature helps locate a front?**

Investigation record

Students decode four station models, plot values on a regional map, draw isobars, and locate a likely front.

Evidence I collected:

What the evidence means:

Practice challenge

1. What do very closely spaced isobars most strongly indicate?

A. A strong pressure gradient and faster wind

B. No atmospheric motion

C. Exactly 100 percent humidity

D. A change from weather to climate

Exit ticket

Name three observations that may change across a front.

UNIT 4 • DAY 22 • ESS.7.1.4

Clouds, Satellites, and Radar

I can: I can compare what surface observations, satellites, and radar reveal.
Essential question: Why do meteorologists need more than one kind of image?

Words to know

satellite • visible imagery • infrared imagery • water vapor imagery • radar • reflectivity

1. Satellites observe from above

Visible satellite imagery shows reflected sunlight and is most intuitive during daytime. Infrared imagery estimates cloud-top or surface temperature and works day and night. Water-vapor channels emphasize moisture patterns in parts of the middle and upper atmosphere.

Capture the idea in a phrase, sketch, or example:

2. Radar samples precipitation

Weather radar sends pulses of energy and measures signals returned by particles. Reflectivity helps show precipitation location and relative intensity. Radar does not directly show every cloud and can be affected by distance, beam height, terrain, or non-weather targets.

Capture the idea in a phrase, sketch, or example:

3. Combine evidence

A satellite image may reveal the size and organization of a cloud shield before rain reaches a location. Radar shows where precipitation is occurring and moving. Surface stations verify what is happening near the ground. Forecast confidence increases when sources agree.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Bright radar colors generally mean stronger returned energy, not automatically a tornado or even precipitation reaching the ground.

Evidence check

1. **Which tool is best for current precipitation location?**

2. **Why compare radar with surface observations?**

Investigation record

Teams match evidence questions to the best tool, then use a short image sequence to estimate storm direction and speed qualitatively.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match the tool to its strongest use.

A. conditions measured near the ground

B. precipitation location and relative intensity

C. cloud-top temperature day or night

D. daytime reflected cloud patterns

_____ 1. Visible satellite

_____ 2. Infrared satellite

_____ 3. Radar reflectivity

_____ 4. Surface station

Exit ticket

Give one question satellite answers better and one radar answers better.

UNIT 4 • DAY 23 • ESS.7.1.3, ESS.7.1.4

Forecast Challenge

I can: I can construct a short forecast from multiple observations and explain uncertainty.
Essential question: What separates a defensible forecast from a confident guess?

Words to know

forecast • model • trend • confidence • uncertainty • verification

1. Begin with the current state

A forecast starts by analyzing current temperature, humidity, pressure, wind, clouds, fronts, radar, satellite, and upper-air patterns. Time trends matter: falling pressure or increasing cloud thickness can be more informative than one value.

Capture the idea in a phrase, sketch, or example:

2. Project motion and change

Meteorologists estimate how systems will move and develop. Front symbols, pressure patterns, radar loops, and upper-level winds provide motion clues. Local terrain, coastlines, and time of day may modify broad patterns.

Capture the idea in a phrase, sketch, or example:

3. Communicate probability and uncertainty

A strong forecast names a time and place, predicts measurable conditions, cites evidence, and communicates confidence. Uncertainty grows when data sources disagree, the pattern changes quickly, or small location differences matter.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: A forecast that does not occur is not necessarily careless; forecasts communicate probabilities within an uncertain system.

Evidence check

1. **Why are time trends important?**

2. **What should lower forecast confidence?**

Investigation record

Forecast teams analyze maps and observations for a fictional North Carolina county and deliver a one-minute evidence-based forecast.

Evidence I collected:

What the evidence means:

Practice challenge

1. Pressure is falling, a cold front is approaching, and radar shows a line of showers moving east. What is the best forecast?

A. Showers and gusty winds are likely before cooler air arrives

B. Clear and calm conditions are certain

C. No temperature change is possible

D. Climate has permanently changed

Exit ticket

List four parts of a defensible forecast.

UNIT 5 • DAY 24 • ESS.7.1.5, ESS.7.2.2

Weather, Climate, and North Carolina

I can: I can compare weather and climate data across North Carolina regions.
Essential question: Why can the same weather system affect the Mountains, Piedmont, and Coastal Plain differently?

Words to know

climate • climate normal • topography • elevation • rain shadow • maritime influence

1. Climate summarizes long-term patterns

Climate descriptions use many years of observations to describe typical ranges, seasonal patterns, and extremes. A climate normal is commonly calculated over a multi-decade period. Daily weather varies around those longer-term patterns.

Capture the idea in a phrase, sketch, or example:

2. North Carolina has regional contrasts

Elevation generally makes the Mountains cooler than lower areas. Slopes can force air upward, changing cloud and precipitation patterns. The Atlantic Ocean moderates some coastal temperatures and provides moisture. The Piedmont lies between these influences.

Capture the idea in a phrase, sketch, or example:

3. One storm meets different surfaces

Terrain can enhance precipitation on windward slopes, cold air can become trapped near the ground, and warm ocean water can supply moisture to coastal systems. Land cover and urban surfaces also influence local temperature and runoff.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Climate boundaries are not sharp walls, and no region experiences exactly the same weather every year.

Evidence check

1. **Why is one year insufficient to define climate?**

2. **How does elevation commonly affect temperature?**

Investigation record

Students compare monthly temperature and precipitation patterns for three North Carolina regions, then apply elevation and ocean influence to one weather event.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which evidence is most appropriate for describing a city's climate?

A. Thirty years of monthly temperature and precipitation records

B. One afternoon thermometer reading

C. A single thunderstorm photograph

D. Tomorrow's hourly forecast

Exit ticket

Give one reason coastal and mountain weather can differ during the same system.

UNIT 5 • DAY 25 • ESS.7.2.2

Greenhouse Effect and Global Temperature

I can: I can analyze a model and data to explain how greenhouse gases influence temperature.
Essential question: How can changing a small part of the atmosphere change Earth's energy balance?

Words to know

greenhouse effect • infrared radiation • energy balance • greenhouse gas • emission • global temperature

1. The natural greenhouse effect supports life

Incoming solar energy is mostly shortwave radiation. Earth absorbs part of it and emits infrared radiation. Greenhouse gases absorb and re-emit some infrared energy, slowing energy loss to space and keeping the lower atmosphere and surface warmer than they otherwise would be.

Capture the idea in a phrase, sketch, or example:

2. Composition affects energy balance

Increasing concentrations of carbon dioxide, methane, and other greenhouse gases increases the atmosphere's ability to absorb outgoing infrared energy. The climate system then warms until incoming and outgoing energy balance again, with responses in oceans, ice, water vapor, and clouds.

Capture the idea in a phrase, sketch, or example:

3. Use multiple lines of data

Scientists analyze atmospheric gas measurements, global surface temperatures, ocean heat, ice, satellites, and physical models. A graph can show correlation, while the tested radiation mechanism provides a cause-and-effect explanation.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: The greenhouse effect is not the same as ozone depletion, and greenhouse gases do not form a solid heat-trapping lid.

Evidence check

1. **Which radiation is strongly involved in the greenhouse effect?**

2. **Why use ocean heat data as well as surface temperature?**

Investigation record

Students sequence an energy-budget model and analyze paired atmospheric composition and temperature datasets to construct a cautious explanation.

Evidence I collected:

What the evidence means:

Practice challenge

1. Arrange the simplified greenhouse-energy pathway.

_____ Greenhouse gases absorb and re-emit some infrared energy

_____ Earth emits infrared radiation

_____ Surface absorbs energy and warms

_____ Sunlight reaches Earth

Exit ticket

Describe the greenhouse effect without using the phrase 'traps heat.'

UNIT 5 • DAY 26 • ESS.7.2.1, ESS.7.2.3

Air Quality and Environmental Indices

I can: I can interpret AQI, UV Index, and Heat Index information and recommend protective action.
Essential question: How do atmospheric measurements become public-health decisions?

Words to know

Air Quality Index • pollutant • particulate matter • ozone • UV Index • Heat Index

1. The AQI communicates pollution risk

The Air Quality Index converts concentrations of major pollutants into categories and health guidance. Ground-level ozone and fine particles are common concerns. Sensitive groups may need precautions at lower levels than the general population.

Capture the idea in a phrase, sketch, or example:

2. Different indices measure different hazards

The UV Index communicates potential harm from ultraviolet radiation. Heat Index estimates how hot conditions feel when humidity limits evaporative cooling. These are not interchangeable with air temperature or the AQI.

Capture the idea in a phrase, sketch, or example:

3. Monitoring supports stewardship

Sensors and forecasts help communities issue guidance. Individual actions can reduce exposure, while community choices can reduce emissions and improve resilience. Wildfire smoke can sharply raise particle pollution even far from the fire.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: An AQI value is not the percentage of clean air, and a lower number generally indicates lower pollution risk.

Evidence check

1. **Why might asthma patients receive guidance before others?**

2. **Why can high humidity raise Heat Index?**

Investigation record

Teams rotate through school-day scenarios and choose protective actions for different groups using provided index guidance.

Evidence I collected:

What the evidence means:

Practice challenge

1. Wildfire smoke raises fine-particle pollution. Which public information is most directly relevant?

A. Air Quality Index

B. Moon phase

C. Tide chart

D. Cold-front symbol only

Exit ticket

Choose one index and state what it measures or communicates.

UNIT 5 • DAY 27 • ESS.7.2.3

Thunderstorms, Lightning, and Tornadoes

I can: I can explain storm hazards and select evidence-based protective actions.
Essential question: Why is the safest response sometimes different from the most visible threat?

Words to know

thunderstorm • instability • updraft • downdraft • lightning • tornado warning

1. Thunderstorms need ingredients

Thunderstorms require moisture, unstable air, and a lifting mechanism. Rising warm moist air forms a strong updraft. Condensation and freezing build a tall cumulonimbus cloud. Rain-cooled downdrafts can produce gusty winds and help end or reorganize the storm.

Capture the idea in a phrase, sketch, or example:

2. Every thunderstorm produces lightning

Charge separation inside a storm creates lightning. Thunder is the sound produced by rapidly heated and expanding air. If thunder can be heard, lightning is close enough to be dangerous. A substantial building or hard-topped vehicle is safer than an open shelter or tree.

Capture the idea in a phrase, sketch, or example:

3. Warnings demand action

A severe thunderstorm warning or tornado warning means hazardous weather is occurring or imminent in the warned area. For a tornado warning, move to a small interior room on the lowest level, away from windows, and protect the head and neck. Follow official local instructions.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Highway overpasses are not safe tornado shelters, and opening windows does not protect a building.

Evidence check

1. **What three ingredients support thunderstorm development?**

2. **What should students protect during tornado sheltering?**

Investigation record

Students identify safer shelter areas on a school plan and respond to timed lightning, severe thunderstorm, and tornado scenarios.

Evidence I collected:

What the evidence means:

Practice challenge

1. Match the hazard to the safer response.

A. stay away from windows and trees

B. never drive or walk through floodwater

C. lowest interior room; protect head and neck

D. enter a substantial building or hard-topped vehicle

_____ 1. Lightning nearby

_____ 2. Tornado warning

_____ 3. Flash flooding

_____ 4. Damaging wind

Exit ticket

What should you do if you hear thunder during an outdoor activity?

UNIT 5 • DAY 28 • ESS.7.2.3

Hurricanes, Floods, and Winter Weather

I can: I can compare major North Carolina weather hazards and select mitigation strategies.
Essential question: Why can the greatest danger from a storm occur far from its center?

Words to know

tropical cyclone • storm surge • inland flooding • flash flood • winter storm • mitigation

1. Hurricanes contain several hazards

Tropical cyclones draw energy from warm ocean water and release energy as water vapor condenses. Hazards include storm surge, large waves, extreme rainfall, inland flooding, damaging wind, tornadoes, and power loss. Impacts extend far from the eye and coast.

Capture the idea in a phrase, sketch, or example:

2. Floodwater hides danger

Flood depth and current can be difficult to judge. Water can conceal washed-out roads, debris, contamination, and electrical hazards. Move away from flood-prone areas when directed and never drive through flooded roads.

Capture the idea in a phrase, sketch, or example:

3. Winter precipitation depends on vertical temperature

Snow remains frozen through a cold atmospheric column. Sleet melts and refreezes before reaching the ground. Freezing rain melts aloft and freezes on contact with a surface below freezing. Ice can make travel and power systems dangerous.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Hurricane category describes wind intensity, not the total risk from rain, surge, tornadoes, or local vulnerability.

Evidence check

1. **Why can inland locations flood during a hurricane?**

2. **What distinguishes freezing rain from sleet?**

Investigation record

Teams match hazard evidence with short- and long-term mitigation strategies, then interpret winter precipitation profiles.

Evidence I collected:

What the evidence means:

Practice challenge

1. A hurricane weakens after landfall but moves slowly across central North Carolina. Which threat may increase?

A. Prolonged inland flooding

B. Storm surge in the mountains

C. Loss of all atmospheric oxygen

D. Permanent reversal of global winds

Exit ticket

Name one hurricane hazard not represented by category alone.

UNIT 5 • DAY 29 • ESS.7.2.1, ESS.7.2.3

Weather-Ready Community Performance Task

I can: I can communicate a hazard forecast and practical mitigation plan for a North Carolina community.
Essential question: How can scientific information reduce risk without creating panic?

Words to know

risk • hazard • exposure • vulnerability • preparedness • resilience

1. Risk combines more than the storm

A hazard is a potentially damaging event or condition. Exposure describes people and property in harm's way. Vulnerability describes how easily they can be harmed. Risk can increase even when the physical hazard stays the same.

Capture the idea in a phrase, sketch, or example:

2. Preparedness and mitigation differ

Preparedness includes plans, alerts, supplies, drills, and communication before an event. Mitigation reduces future impacts through stronger buildings, drainage, protected floodplains, shade, cleaner air, or other long-term changes.

Capture the idea in a phrase, sketch, or example:

3. Effective messages are specific

A useful message names the hazard, location, timing, expected impacts, people who may need extra support, and concrete actions. It cites evidence, acknowledges uncertainty, and points to official updates. Avoid sensational language.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Individual preparation matters, but communities also need systems that reduce unequal exposure and vulnerability.

Evidence check

1. **What is the difference between hazard and vulnerability?**

2. **Why include uncertainty?**

Investigation record

Teams create a one-page weather-ready brief for a fictional North Carolina community facing a specified hazard.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which message is most useful?

A. Flooding is possible in low areas after 6 p.m.; avoid flooded roads and follow county alerts

B. A terrible disaster will definitely happen

C. Weather might be bad sometime

D. Do not worry because forecasts are sometimes wrong

Exit ticket

Name one immediate protective action and one long-term mitigation for your hazard.

UNIT 5 • DAY 30 • ESS.7.1.1-ESS.7.1.5, ESS.7.2.1-ESS.7.2.3

Weather Systems Synthesis and Summative Assessment

I can: I can integrate atmosphere, water, energy, circulation, forecasting, climate, and safety concepts.
Essential question: How do Earth's atmosphere and human decisions work together to shape weather risk?

Words to know

synthesis • system • evidence • prediction • mitigation • stewardship

1. Weather is a connected system

Atmospheric composition and vertical structure affect pressure, temperature, and radiation. Solar energy and gravity drive water pathways. Uneven heating creates convection and pressure differences; rotation shapes global circulation and the jet stream. Air masses and fronts organize changing weather.

Capture the idea in a phrase, sketch, or example:

2. Forecasts integrate observations

Tools measure surface variables, while satellites, radar, maps, and models extend what can be observed. Meteorologists compare trends and system motion, make probabilistic predictions, verify results, and revise models.

Capture the idea in a phrase, sketch, or example:

3. Science supports safer choices

Climate patterns help communities anticipate the range of hazards they may face. Monitoring air quality and changing atmospheric composition supports health and stewardship. Clear communication, preparedness, and mitigation reduce impacts.

Capture the idea in a phrase, sketch, or example:

Watch for this mix-up: Mastery is not memorizing isolated terms; it is using relationships and evidence to explain and predict.

Evidence check

1. **How are convection and fronts connected?**

2. **Why combine radar, satellite, and surface data?**

Investigation record

Students complete a rapid concept-map review, the summative assessment, and a reflection identifying their strongest evidence-based skill and next learning goal.

Evidence I collected:

What the evidence means:

Practice challenge

1. Which chain best connects the whole unit?

A. Solar energy creates uneven heating; pressure and density differences move air; systems are observed to forecast hazards

B. Weather occurs because clouds choose to move

C. Climate changes every hour and causes instruments

D. Air pressure is unrelated to wind or clouds

Exit ticket

What is one way your thinking about forecasts changed?

Course concept map: after learning

Rebuild your Day 1 concept map. Use labeled arrows to connect at least ten ideas and include evidence for two connections.

Sources and currency note

The instructional sequence is aligned to the North Carolina science standards adopted in 2023 and implemented in 2024-25. Science explanations and safety guidance draw on the following authoritative public resources. Accessed August 25, 2026.

NCDPI Science Standards and Supporting Resources
https://www.dpi.nc.gov/districts-schools/classroom-resources/office-teaching-and-learning/standard-course-study/science/standard-course-study-supporting-resources

NCDPI Science
https://www.dpi.nc.gov/districts-schools/classroom-resources/office-teaching-and-learning/standard-course-study/science

NOAA JetStream Weather School
https://www.noaa.gov/jetstream

NOAA Weather Systems and Patterns
https://www.noaa.gov/education/resource-collections/weather-atmosphere/weather-systems-patterns

National Weather Service Education
https://www.weather.gov/education/

AirNow AQI Basics
https://www.airnow.gov/aqi/aqi-basics/

NASA Climate Kids: Greenhouse Effect
https://climatekids.nasa.gov/greenhouse-effect/

Real-time weather, air-quality, and hazard information changes. Use current official local alerts for operational decisions. This package supports instruction and is not a substitute for district safety policy or emergency management guidance.