



Clouds, Evaporation, and Weather in the "Hollow"

National Standards > Science > Earth and Space

NS.K-4.4, NS.5-8.4 Earth and Space Science (Grade 4) (Grades 5 & 6)

- Objects in the sky
- Changes in earth and sky
- Earth in the solar system

NS.K-4.1, NS.5-8.1 Science as Inquiry (Grade 4) (Grades 5 & 6)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Kentucky: Science > Objects in the Sky Standard

S-4-ESS-5

- Understand that common objects in the sky (e.g., stars, clouds) have properties, locations and movements that can be observed and described.

Kentucky: Science > Structures of the Earth System Standard

S-5-ESS-2

- Explore the characteristics of the atmosphere and how the water cycle affects the atmosphere, clouds, weather, and climate.

S-6-ESS-4

- Identify phenomena (e.g., growth of plants, winds, water cycle, ocean currents) on the Earth caused by the Sun's energy.

Kentucky: Science > Scientific Inquiry > Scientific Ways of Knowing and Working Standard

S-4-SI-1, S-5-SI-1, S-6-SI-1

- Identify; Ask simple scientific questions that can be answered through observations combined with scientific information.

S-4-SI-2, S-5-SI-2, S-6-SI-2

- Use appropriate; use simple equipment, tools, skills, and mathematics in scientific investigations.

S-4-SI-3, S-5-SI-3, S-6-SI-3

- Use evidence from simple scientific investigations; logic and scientific knowledge to develop reasonable explanations.

S-4-SI-4, S-5-SI-4, S-6-SI-4

- Design and conduct different kinds of simple scientific investigations; to answer different kinds of questions.

S-4-SI-5, S-5-SI-5, S-6-SI-5

- Communicate designs, procedures, and results of scientific investigations.

S-4-SI-6, S-5-SI-6, S-6-SI-6

- Review and ask questions about scientific investigations and explanations of other students.

Ohio: Science > Earth and Space Science Standard

- Demonstrate an understanding about how Earth systems and processes interact in the geosphere resulting in habitability of Earth.
- Understanding the properties and the interconnected nature of Earth's systems and processes that shape the Earth and Earth's history.

Benchmark(s)

Grade 4

- D. Analyze weather and changes that occur over a period of time.

Grade 6

- C. Describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere (e.g., water cycle, weather and pollution).

Ohio: Science > Science Inquiry Standard

- Develop scientific habits of mind [for] use of the processes of scientific inquiry to ask valid questions and to gather and analyze information.

Benchmark(s)

Grades 4 & 5

- A. Use appropriate instruments safely to observe, measure and collect data when conducting a scientific investigation.
- B. Organize and evaluate observations, measurements and other data to formulate inferences and conclusions.
- C. Develop, design and safely conduct scientific investigations and communicate the results.

Grade 6

- A. Explain that there are differing sets of procedures for guiding scientific investigations and procedures are determined by the nature of the investigation, safety considerations and appropriate tools.
- B. Analyze and interpret data from scientific investigations using appropriate mathematical skills in order to draw valid conclusions.

Ohio: Science > Scientific Ways of Knowing Standard

- Realize that the current body of scientific knowledge must be based on evidence; be productive, logical, subject to modification and limited to the natural world.

Benchmark(s)

Grades 4 & 5

- B. Describe different types of investigations and use results and data from investigations to provide the evidence to support explanations and conclusions.

Grade 6

- A. Use skills of scientific inquiry processes (e.g., hypothesis, record keeping, description, explanation).

The location of The Legend of Sleepy Hollow is a "hollow," or valley; a place set in the depression between ranges of hills. Weather in a "hollow" can consist of "fog and mist," both the result of water condensation and precipitation from clouds. It is "fog" and "mist" that provides for an "eerie" or "creepy" mood and setting for the play.

Objective

Students will examine the characteristics, attributes, and conditions for clouds and water vapors.

Students will work collaboratively in small groups to complete the listed activities.

Student will maintain a science journal to record their ideas, collect data, record explorations, and share conclusions.

Vocabulary

- condensation
- evaporation
- dew point
- dissipate
- saturation
- precipitation
- cumulus
- stratus
- cirrus
- nimbus
- alto
- troposphere

Activity

Task 1

Materials:

- Collection of pictures representing all levels and types of clouds from the troposphere, gathered from various print and electronic, online sources (e.g., alto, medium, high, and low; cumulus, stratus, cirrus, nimbus).
- Science journal (a notebook per student)
- Pencils, colored pencils, crayons, markers
- Local newspaper
- Chart paper

Activity

Teacher will:

- Share a collection of pictures of a variety of different cloud formations. (Leave unsorted.)
- Take the students outside to conduct cloud observations. (This can occur several times since cloud formations are associated with different weather conditions.)
- Use illustrations, drawn on the board or chart paper, to explain the development of a cloud. Make the connection of cloud formation to the water cycle during this discussion. (Use print or Internet resources as a guide in showing the development of a cloud.)

Students will:

- Make observations, record descriptions and compare data. Activity focus is on the appearance of clouds in size, shape, and density.
- Students either sit or lay down on the ground to watch cloud movement and changes.
- Students record their observations in a journal along with the date and the current weather conditions. (Weather conditions can be found on a weather Internet site or in the local newspaper. This activity will help the students make connections between the types of clouds and the conditions associated with them.)
- Students will illustrate the process of cloud formation in their journals.

Task 2

Materials

- Teakettle
- Water
- Hotplate
- Plate
- Oven mitt

Activity

Teacher will:

- Demonstrate water vapor condensation using a teakettle.
- Boil water in a teakettle on a hot plate.
- Discuss that water vapor is escaping from the spout, as the kettle begins to whistle,
- Ask the questions, "Where are the vapors going?" "How are they formed?" "If the vapors could be collected, what would happen?"
- Place a plate over the escaping water vapor to collect water droplets on the plate.
- Discuss with students what the collection and dripping of water represent, as the droplets start to drip from the plate.
- Explain the stages in the formation of a cloud until it becomes saturated with water leading to precipitation.
- Ask students to predict how the demonstration relates to the formation of "fog," fine particles of water suspended close to the ground.

Students will:

- Record an illustration and written description of the demonstration of precipitation in their journals.

Task 3

Materials (For small groups of 4 students each)

- 1 wide mouth Mason jar
- Water
- Saran wrap
- A handful of ice cubes

Activity

Teacher will:

- Form small students groups of 4 students each for exploration of cloud formation.
- Distribute to each group a wide mouth Mason jar, 1 cup of boiling water, a section of saran wrap large enough to cover the mouth of the jar and partially down the sides, and a handful of ice cubes.
- Facilitate the process of cloud and precipitation formation. (A cloud will form inside the jar as the rising warm air collides with the cold air created by the ice cubes placed on top of the saran wrap.)
- Follow the experiment with a discussion for students to share their observations and inquiries.

Students will:

- Enter a journal entry to answer the questions, "How is a cloud formed?" "What makes fog?" or a similar question. (If students are familiar with inquiry-based activities, they may create a question of their own.)

- Make a guess/hypothesis for cloud, water vapor and precipitation formation based upon the materials presented for use of this activity and the question prompt.
- Conduct exploration of cloud, water vapor and precipitation formation by placing the boiling water into the jar. Swish the water around slightly being careful not to splash it out the top. (Students may need an oven mitt to protect against the heat.)
- Immediately seal the saran wrap tightly over the mouth of the jar so that it is smooth and not drooping in the center.
- Place a handful of ice cubes on top of the saran wrap.
- Record with illustrations and written notes, observations of the experiment processes and results. (One student might serve as a timekeeper so that observation can be connected to a time frame.)
- Infer and write conclusions based upon their observations. If your students need assistance, create a list of questions for them to answer in their journals related to the concept of cloud water vapor and precipitation formation emphasizing observed changes.

Task 4

Materials (For small groups of 4 students each)

- 2 liter bottle with cap
- Water
- Matches

Activity

Teacher will:

- Distribute to each student group, a 2-liter bottle with cap, and about 2 inches of warm water in the bottle, and matches. (*An adult should handle the matches.*)

Students will:

- Conduct an exploration that illustrates faster cloud formation when water droplets are able to attach themselves to “particles.”
- Examine the materials and write a prediction as to what will happen in the experimentation. (The prediction should make connections to the previous activity with an explanation for the additional use of the matches.)
- Record illustrations and written observations. A timekeeper may be appointed to share time frames for students to record along with their observations.
- Conduct hands-on exploration.
- Place warm water into the bottle and an adult lights, blows out, and drops the match into the bottle. Immediately, cap the bottle tightly. Squeeze and shake the bottle. Release the bottle and a cloud will form. Continue the process to create other clouds.
- Review their observations, make connections to the previous activity and include differences between the exploration and similarity of the results...a cloud.
- Write a conclusion statement or generalization based upon their observations to explain the formation of a cloud, and how the addition of the match affected the development of the cloud.

Task 5

Materials

- Cloud pictures from Activity 1
- Chart paper

Activity

Teacher will:

- Facilitate a class discussion focusing on cloud development.
- Review the “steps” in the formation.
- Guide students to question why the clouds they observed in the beginning in photos look different than the ones they created in the jar and bottle.
- Revisit to the cloud pictures for the students to compare. Ask students to compare size, shape, and texture of the clouds. (Pictures should show that some clouds are higher in the sky than others.)
- Guide students in placing pictures into classifications of low (nimbostratus, stratus, cumulus), medium (stratocumulus, altostratus, altocumulus), and high (cirrocumulus, cirrus, cirrostratus) clouds.
- Discuss the Latin root words and how the root describes the appearance of basic and combination cloud formations.
- Discuss how altitude affects the temperature of the air and the formation of water vapor.
- Transfer this information into a chart that shows the distances above sea level for each of the levels of clouds.
- Discuss the weather conditions for formation of each of the type of cloud. (Cumulus clouds are fair weather clouds, but can grow into a cumulonimbus thunderhead. Cirrus clouds often indicate approaching rain. Stratus clouds are usually close to the earth’s surface and contain lots of moisture or water vapor; therefore they usually accompany rain and a dark gloomy sky.)
- Introduce fog as a stratus cloud that is very close to the surface, usually occurring on cool, still mornings as the ground’s heat meets the cool air causing condensation.

Students will:

- Group pictures based upon similarities in height in the troposphere and cloud size, shape and texture.
- Make and discuss the connection between the time of year, fall, and the formation of fog.

Performance Assessment:

Teacher will evaluate students’ abilities to:

- Present evidence of understanding in their written and illustrated journal entry explanations.
- Identify correct concepts and misconceptions.
- Address the misconceptions in their discussions following each activity. (Ask students with exemplar explanations of concepts written in grade level appropriate vocabulary to share their ideas with the remainder of the class.)
- Create a Cloud Project identifying the different types and levels of clouds, the meanings for the root word of the names, the type of weather associated with the cloud type, and an illustration of the cloud. (To address different learning styles, allow students, singularly, in pairs, or in small groups, to decide what their product will look like and how the information is presented (e.g., books, posters, poems, song or rap, diorama, PowerPoint presentation, skit, newspaper article, newscast, dramatization, etc.).
- Help create a rubric for evaluating the products based upon specific objectives.
- Contribute feedback in a gallery walk. Post chart paper at several locations around the room. Each piece will have a different category at the top (i.e. Cumulus clouds, condensation, low-level clouds, fog, etc. Students walk, in small

groups or pairs from paper to paper, to add information related to the topic on the chart paper. When students reach a new category, they read what classmates have listed and add additional new information. Illustrations and words are both appropriate.)

- Contribute to debriefing and discussion about information on the charts
- Write, as final journal entry, an explanation for "fog" found present in the production, The Legend of Sleepy Hollow. The explanation will include a description for how real fog is formed, an explanation for how fog was created for the production, and the importance of its inclusion in the storyline.

Related resources (Print)

Weather Explained by Derek Elsom

Science Projects About Weather by Robert Gardner and David Webster

Experiments with Weather by Miranda Bower

How The Weather Works by Michael Allaby

Simple Weather Experiments with Everyday Materials by Muriel Mandell

Weather by Paul Lehr

The Cloud Book by Tomie de Paola

Electronic/Online:

Lesson plans related to various cloud topics for grades 4-12.

www.eduref.org/cgi-bin/lessons.cgi/Science/Meteorology

These 2 sites are lessons posted by teachers relating to clouds and weather topics.

www.teachers.net/lessons/posts/1020.html

www.teachers.net/lessons/posts/396.html

Weather conditions and postings, this site gives explanations for weather phenomena.

www.usatoday.com/weather

Connect to pop quizzes and video clips through science/weather/clouds

www.brainpop.com

Web Quests for extension and differentiation:

<http://www.districts96.w-cook.k12.il.us/webquests/quests/wolfb6weather.html>

<http://eprentice.sdsu.edu/F03X1/ctrunzo/webquest/t-webquest.htm>

<http://www.davidson.k12.nc.us/webquests/weather/weather.htm>

<http://www.msu.edu/~johns742/weather%20/Webquest/Weather%20/Webquest.htm>