National Aeronautics and Space Administration

NASA eClips™

Guide Lites

Interactive Lesson: Clouds
Grades 3-5

National Education Standards:
ESS2.A: Earth's Materials and Systems
All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)
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. (MS-ESS2-6)
This document is based upon work supported by NASA under award No. NNX16AB91A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration (NASA).
Published August

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Student Misconception
Students often incorrectly think that a cloud's only purpose is to create precipitation. Students often do not realize that clouds play an important role in Earth's energy budget.

Objective
In this activity, students will explain the role of clouds in Earth's energy budget including reflection, shadowing, absorption, trapping heat at night as a result of watching the NASA Spotlite video, learning the vocabulary collaboratively, and discussing the relationship of clouds to Earth's energy budget.

Time Frame
Approximately 45 minutes (pretest, video review and discussion (20 minutes), collaborative vocabulary with Frayer Model (25 minutes), posttest. Additional time needed for completion of extension activities.

Materials:
Per student: copy of pretest and posttest (alternatively, these can be completed online)
Per small group: copy of Frayer Model (alternatively, these can be completed online)
Per classroom: chart paper for posting final vocabulary definitions

Background Information
- Clouds play an important role in Earth's energy budget.
- Clouds can block the sun's radiation by reflecting part of the rays back into space.
- The shadowing effect of clouds helps to make Earth's surface cooler.
- Clouds absorb thermal infrared radiation (heat) that is emitted from Earth's surface to space.
- Higher cirrus clouds at night act as a blanket to trap Earth's heat to keep Earth warmer than when there are no clouds in the sky.
- Low, thick cumulus clouds reflect incoming solar energy back to space.

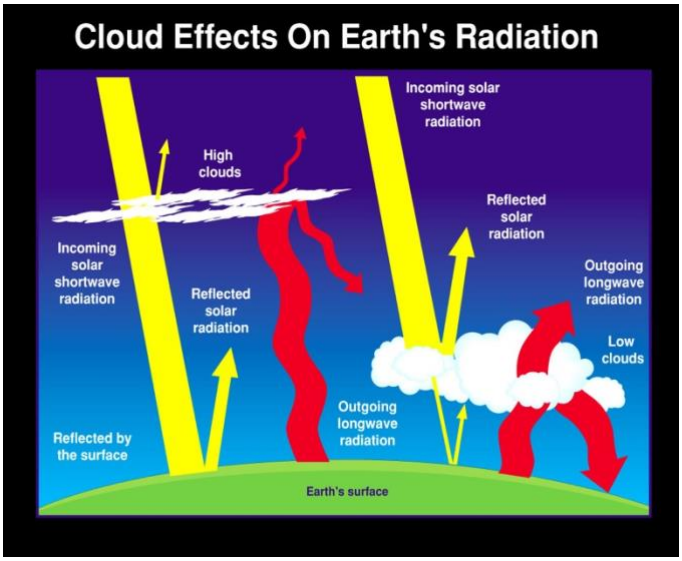


Image credit: http://www.climate4you.com/ClimateAndClouds.htm

Pre-Assessment
Probe for students' prior knowledge using one or both of these pre-assessments.

1. Pre-test items can be found at the ClassFlow Marketplace – *NASA Spotlite Interactive Lesson Plan – **Clouds** Pre / Post Test.*
https://prod.classflow.com/classflow/#!/product/itemId=8505f4def2ae4be8a9d89fa77bfdf84f

2. Discussion questions:
   - ❑ What do you know about clouds?
   - ❑ What are the functions of clouds?
   - ❑ How are clouds part of Earth's energy budget?
   - ❑ What is the difference between the different types of clouds?

Engage

1. Ask students to watch the Spotlite video on clouds that can be found at the following link, https://youtu.be/uGVTk7hz_7U. After viewing the video, lead a discussion with students to identify the misconception addressed in the video.

   (Misconception: A cloud's only purpose is to create precipitation.)

2. Identify key vocabulary words and phrases in the video.

   (Examples: precipitation, energy budget, absorb, reflect, radiation, infrared, rays, cirrus, cumulus. Additional words should be added as needed.)

**These words, and other key vocabulary terms, can be found in the NASA eClips™ Virtual Vocabulary, https://nasaeclips.arc.nasa.gov/teachertoolbox/vocab.

Explore and Explain

Use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

Using a digital interactive Frayer Model enables students to explore ideas collaboratively and simultaneously on the same digital document.
Several digital Frayer models can be found at:

- ClassFlow:
http://tinyurl.com/FrayeronClassFlow
- PDF Filler:
http://tinyurl.com/FrayeronPDFfiller
- Google Slides
https://docs.google.com/presentation/d/1a8RaLcmOmSwlYxZBFPWHgbkoEZrJnnp5gicNeElXzjc/edit?usp=sharing

Implementation Note

Within the Frayer Model, students EXPLORE concepts through brainstorming and researching AND EXPLAIN and synthesize their understanding.

Example: Place the word ***precipitation*** in the center of the graphic organizer.

1. Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. **(EXPLORE):** Ask students to brainstorm *characteristics of* ***precipitation*** and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. **(EXPLAIN):** Next, ask students to add *examples* and *non-examples* in the Frayer model. *(Emphasize the higher level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?)*
5. Using the information provided, ask students to develop their own definition of the word ***precipitation*** that is clear and concise. An example to guide work is started below.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word.
8. Compile final definitions and post so all students have access for later work.

Implementation Note

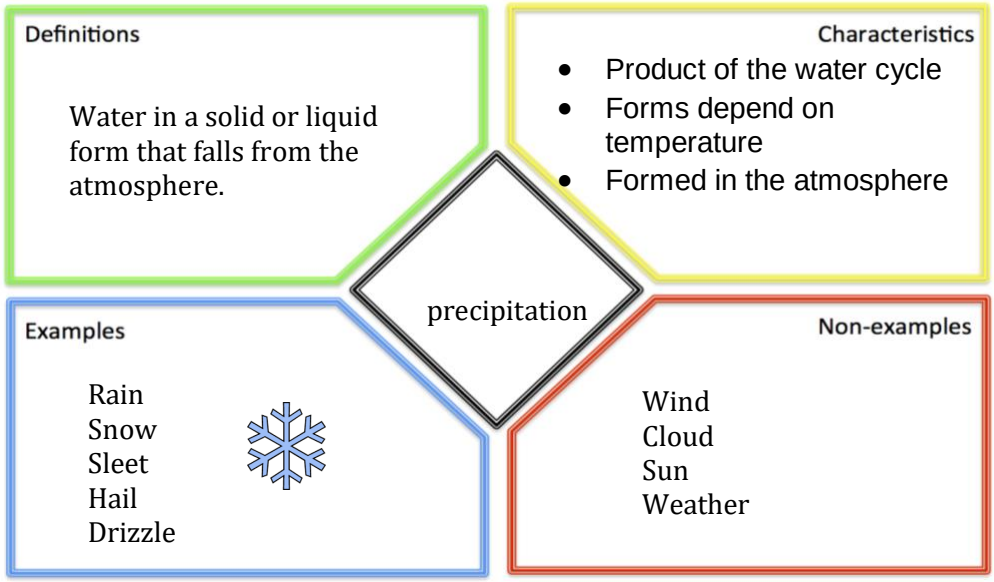
Doing this activity in pairs or teams builds students' collaboration skills.

Implementation Note

Developing their own definitions helps students build conceptual understanding.

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.



Evaluate

Return to these discussion questions:

- ❑ What do you know about clouds?
- ❑ What are the functions of clouds?
- ❑ How are clouds part of Earth's energy budget?
- ❑ What is the difference between the different types of clouds?

Compare student responses to Pre-assessment and Evaluate questions to determine if students have a clear understanding of the vocabulary.

Posttest items can be found at the ClassFlow Marketplace – *NASA Spotlite Interactive Lesson Plan – **Clouds** Pre / Post Test.*
https://prod.classflow.com/classflow/#!/product/itemId=8505f4def2ae4be8a9d89fa77bfdf84f

Extend

For additional videos and activities to reinforce content, visit the related web site linked to the NASA eClips™ video **Our World: Monitoring the Earth's Climate with CERES.**
https://nasaeclips.arc.nasa.gov/search/?terms=ceres&v=our-world-monitoring-the-earths-climate-with-ceres

To further assess students' understanding of the role of clouds in Earth's energy budget, have them make cloud posters showing the different types of clouds, the energy coming from the sun and how clouds interact with this incoming energy and affect it.

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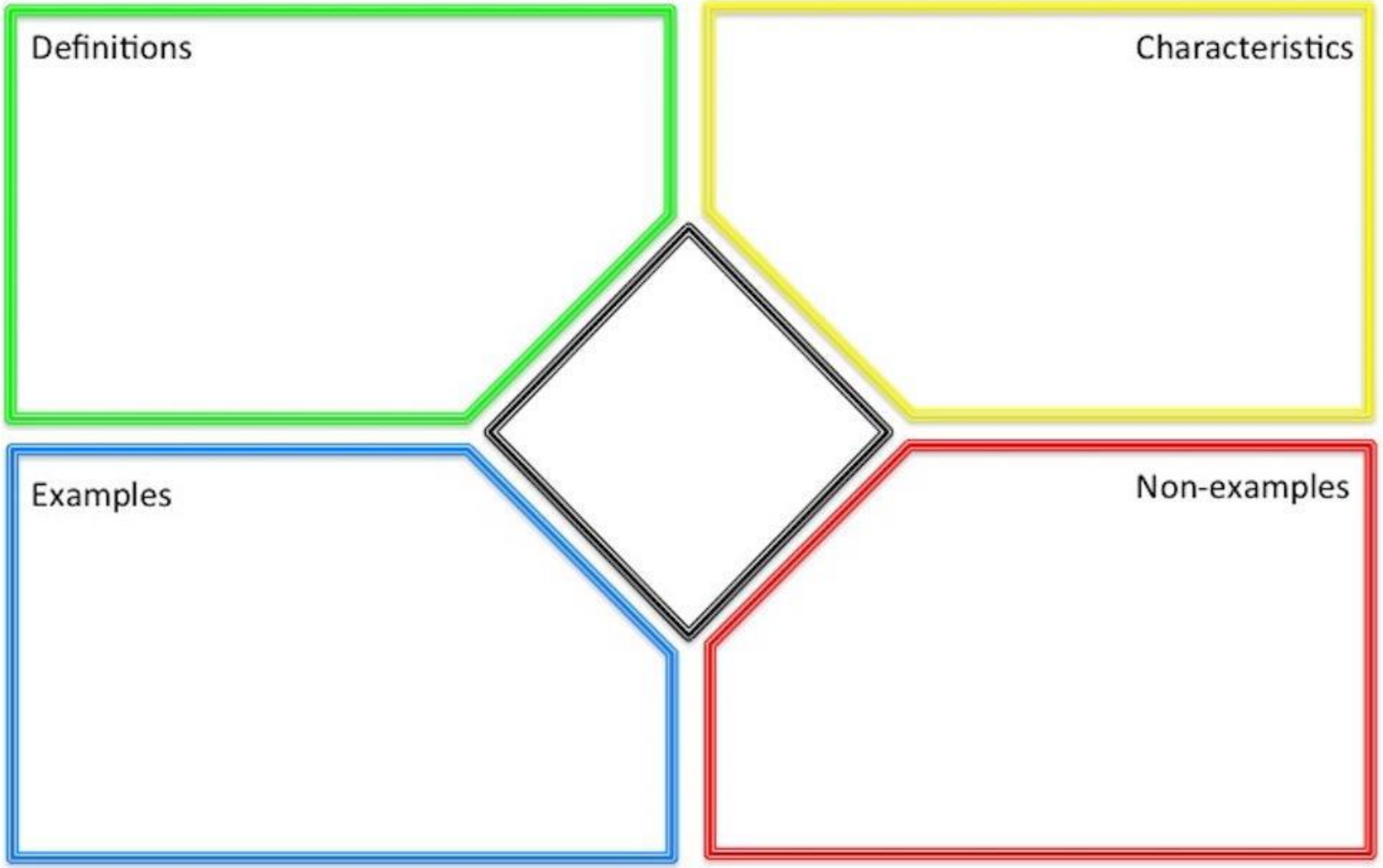

Clouds Pre / Post Test
NASA Spotlite Interactive Lesson

This assessment was designed for the student produced NASA Spotlite video Clouds. https://youtu.be/uGVTk7hz_7U

1. Which factor can help balance Earth's temperature?
   A. satellites
   B. comets
   C. meteorites
   D. clouds

2. When the skies are clear of clouds, what can reach Earth's surface and lead to warmer temperatures?
   A. more rain
   B. more energy
   C. more meteorites
   D. more precipitation

3. Low level thick clouds that reflect incoming solar energy are called _____.
   A. cumulus clouds
   B. stratus clouds
   C. contrails
   D. cirrus Clouds

4. Some clouds act as a blanket and make Earth _____.
   A. cooler
   B. experience nothing
   C. warmer
   D. lighter

5. Five friends were looking at different clouds in the sky. They wondered how those clouds affected life on Earth. Which statement is correct?
A. clouds only make rain and other precipitation
B. clouds cause precipitation and changes in Earth's temperature
C. clouds do not affect Earth at all
D. clouds are not important because they are so far away

**This question is adapted from Page Keeley's Probe, Uncovering Students Ideas in Science Vol. 3 page 155.

NASA SPOTLITE
Science for students by students

ANSWER KEY

Clouds Pre / Post Test
NASA Spotlite Interactive Lesson

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For an electronic version use this link to view to the NASA Spotlite Interactive Lesson Plan **Clouds** Pre / Post Test at ClassFlow:
https://prod.classflow.com/classflow/#!/product/itemId=8505f4def2ae4be8a9d89fa77bfdf84f