



## Physical Aspects of Climate - Atmosphere (Part 2:4)

**Type of Lesson:** Direct Instruction, Lab

**Description of lesson:** This program covers the physical aspects of climate change. There are three main activities that cover the direct content: Atmosphere, Oceans, and Cryosphere. This program is intended for classroom teachers to use as direct instruction and a hands-on activity for the students to complete. Direct instruction is given as a PowerPoint the teacher can project and a student note sheet has been created for interactive notebooks, or for students to fill out digitally. In addition, a lab has been curated that pairs with the material so students can have a kinesthetic learning experience to reinforce the material learned. Activities for vocabulary development and review have been included, as well as an end of the unit assessment where students show their knowledge of how the interactions between the Atmosphere, Cryosphere and Ocean create climate zones.

**Enduring Understandings:**

Climate is made up of multiple variables, a change in any of those variables can have a major impact on the planet

**Essential Questions:**

If predicted future impacts of Climate Change are as bad as the scientific community is predicting, is our home planet doomed or saveable?

**Academic Standards:**

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth’s systems result in changes in climate.

HS-ESS2-8.\* Construct an explanation of how heat (energy) and water (matter) move throughout the oceans causing patterns in weather and climate.

HS-ESS2-9.\* Construct an explanation for how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and transfer energy

HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ENV1-2.\* Use a computational representation to illustrate that humans are part of Earth's ecosystems and how human activities can, deliberately or inadvertently, alter ecosystems

HS-ENV1-3. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

**Student learning targets:**

- How the atmosphere affects climate
- How CO2 increases temperature of the atmosphere
- How the atmosphere circulates and it’s not just one place producing the CO2.
  - Students seem to have the misconception that if the trees are cut down in an area, then that area will not have oxygen. Reinforce with them that air moves and that countries that emit large amounts of CO2 affect the whole planet



**Assessment task** - At the end of part 4 students are given a climate zone and are tested to see if they can put together how the atmosphere, cryosphere, and hydrosphere come together to form that climate zone. Students will be tested in a Free Response format. Please see lesson 4 for a complete description of the assessment task

**Differentiation:**

Students who are absent for the lab can do this alternative online version  
<https://phet.colorado.edu/en/simulations/greenhouse-effect/about>

**Accommodations:**

- Pre-filled notes printed out for students
- Embedding the PowerPoint in the LMS so that students can follow along at their own pace
- Vocabulary as a reference only instead of having them fill it out
- The use of notes during assessments

**Prior Learning:**

The climate unit is based on students who have learned about the atmosphere, hydrosphere and cryosphere. Before starting this unit students should be familiar with the following concepts

- Convection, ocean circulation and atmospheric circulation
- Greenhouse gasses
- Atmospheric composition
- Water holds more heat
- Carbon cycle, sources and sinks
- Albedo
- Coriolis effect
- Density

**Prerequisite skills:**

- Asking Questions
- Defining problems and creating solutions
- Data analysis
- Graphing
- Defending and argument with evidence
- Writing a free response

**Materials**

- Printed copies of the note sheet for notebooks (or a pdf of note sheet for students to fill out digitally)
- Printed copies of the Vocabulary building note sheet or a pdf for students to fill out digitally
- 2 Tupperware containers with lids
- 2 thermometer probes (digital)
- 2 grow lights (must be infrared)
- 2 ring stands
- Small beaker
- Dry ice
- Black construction paper
- Scissors
- Ruler
- Timer or stopwatch

**Technology:**

- Computer/Projector to present direct instruction material (PowerPoint)
- Ipad/Chromebooks to complete the PhET simulation on
- Vernier Temperature probes?

**Vocabulary Development:**

## Procedures:

Display the Aspects of Atmosphere PowerPoint

Review with students what they have learned about Atmosphere in previous units and what they learned about the atmosphere in the previous lesson. Display slide 6 to the class.

Ask the following question and have students brainstorm with each other until they have an answer

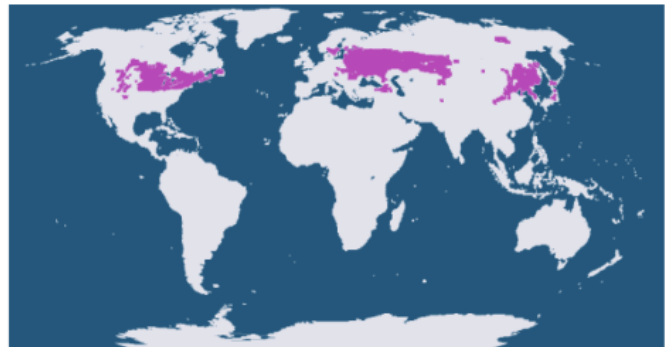
## How are climate regions created?

Humid continental climate (what we have here in Indiana)

Precipitation: Gets precipitation all year as either rain or snow

Temp: Hot summers and cold winters

**Atmosphere -**



As students discuss, and maybe write down answers on a shared whiteboard, guide students to remember what they've learned about atmosphere that will help them answer this question:

- Warm air holds more water
- Warm air moves up from the Gulf of Mexico
- Cold air moves down from Canada
- Cold air is drier.

Guide students to use this information to come up with an explanation on how the atmosphere determines the climate in this region. A possible answer to this question is:

**“warm wet air comes from the distant oceans. The warmer the atmosphere the more water it can hold and is humid - low pressure - clouds”**

Continue the rest of the direct instructions with the note sheet

When the lesson is complete: consider doing this exit ticket as a check in with students. On a half sheet of paper have students complete a 3-2-1

- 3 most important pieces of information from the lesson
- 2 things you found interesting
- 1 question you still have

**Lab:** This lab reinforces the concept of greenhouse effect on the atmosphere. Students are asked to conduct an experiment with two different atmospheric compositions in sealed containers. They will be using heat lamps and



temperature probes to determine how CO<sub>2</sub> affects the temperature of the atmosphere.

Please refer to the following student sheet for procedures and material lists

Atmosphere Lab

Here is a similar lab set-up done with 2 liter bottles and alka seltzer: [▶ The Greenhouse Gas Demo](#)

**Wrap up:** revisit the climate zone of Indiana. Ask students to brainstorm how this climate region might change due to climate change. Possible answer would be if the air is warmer it can hold more water. So it would be more humid in Indiana. Worse storms. Wetter winters (rain) not snow.

Ask students to dig deeper and think about what impacts that might have on the ecosystems and humans who live in this climate region

**Additional Information for Teachers:**

**Suggested Reading**

<https://www.ipcc.ch/report/ar5/wg2/>

**Suggested Videos:**

<https://www.youtube.com/watch?v=U8pZzYfzFMM>

<https://www.youtube.com/watch?v=rdGtcZSFRLk>

<https://www.youtube.com/watch?v=7fd03fBRsuU>

**Attach:** Aspects of Climate Atmosphere PowerPoint

Aspects of Climate: Atmosphere Notes page

Atmosphere Lab