UNIT 8: STORM CLOUDS

"Climate change is now affecting every country on every continent. It is disrupting global economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow. ***Weather patterns*** *are changing,* ***sea levels*** *are rising,* ***weather events*** *are becoming more extreme and* ***greenhouse gas emissions*** *are now at their highest levels in history. Without action, the world's average* ***surface temperature*** *is likely to surpass 3 degrees centigrade this century. The poorest and most vulnerable people are being affected the most."*

SUGGESTED ACTIVITIES

ACTIVITY 8.1— A Call for Climate Action

The United Nations Sustainability Goal #13 calls for *Climate Action.* Read Goal #13 carefully.

Discussion:

• The world's surface temperature will increase by 3 degrees? The weather in San Diego can fluctuate by 20 degrees every single day. Why is this such an alarming measure?
• "*The poorest and most vulnerable people are being affected the most."* What are some examples of this?
• What does "climate change" refer to? How does it affect weather patterns?
• What is the number one contributing factor to climate change?

Review the most recent findings from the UN's Inter Governmental Panel on Climate Change (IPCC):

• Is the data cited in the IPCC report accurate and reliable? How do we know?
• How is this report different from the others?
• World Leaders continue to meet to discuss next steps in achieving our international climate goals. How are they doing on the goals they have agreed on

📖 **Resource:**

The Nature Conservancy-- The Latest IPCC Report: What it is and Why it Matters

ACTIVITY 8.2— Inconvenient Truths

"We must limit global temperature's rise to 1.5 degrees celsius!"
—Antonio Guterres

• **Watch:** CNN Overview

• **Read:** Neil Halloran warns of the danger of defeatism in the face of dire climate news, saying only if we agree the future is uncertain might we be so bold as to shape it.

• IPCC-CH (@IPCC) **Tweet:** #ClimateChange & cities, energy, health, tourism, agriculture, fisheries, forestry, ecosystems, water, disaster management & insurance. Discover fact sheets with sector-relevant scientific findings from the #IPCC Working Group I #ClimateReport

• **Watch** An Inconvenient Truth

Discuss:

• How can a good, critical reader determine which information is factual, and what source to believe?
• What does the "preponderance of evidence" mean?

Critical Thinking:

• Can scientists be wrong about Climate Change? Can the science be wrong?

ACTIVITY 8.3— The Ocean Makes the Weather

Essential Principle of Ocean Literacy #3:

The ocean is a major influence on weather and climate.

Fundamental Concepts of Ocean Literacy:

3A. The interaction of **oceanic and atmospheric processes** controls weather and climate by dominating the Earth's energy, water, and carbon systems.

3B. The ocean moderates global weather and climate by absorbing most of the **solar radiation** reaching Earth. Heat exchange between the ocean and atmosphere drives the water cycle and oceanic and atmospheric circulation.

3C. **Heat exchange** between the ocean and atmosphere can result in dramatic global and regional weather phenomena, impacting patterns of rain and drought. Significant examples include the El Niño Southern Oscillation and La Niña, which cause important changes in global weather patterns because they alter the sea surface temperature patterns in the Pacific.

3D. **Condensation** of water that evaporated from warm seas provides the energy for hurricanes and cyclones. Most rain that falls on land originally evaporated from the tropical ocean.

Scope & Sequence: Adjust for your Grade Level—

K - 2	3 - 5	6 - 8	9 - 12

Read the Fundamental Concepts 3A, 3B, 3C, and 3D carefully. Read each sentence and identify new words or concepts, such as: atmospheric process, carbon system, solar radiation, heat exchange, El Niño, and condensation.

Define and explain each of these terms.

Watch:

You Tube Video: *The Greenhouse Effect*

ACTIVITY 8.4— The Role of Carbon

The final three *Fundamental Concepts* address the critical issue of carbon:

[Also addressed in **Activity 4.2, Activity 7.3, and Activity 7.4**]

3E. The ocean dominates Earth's **carbon cycle**. Half of the primary productivity on Earth takes place in the sunlit layers of the ocean. The ocean absorbs roughly half of all carbon dioxide and methane that are added to the atmosphere.

3F. The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving **heat, carbon, and water**. Changes in the ocean's **circulation** have produced large, abrupt changes in climate during the last 50,000 years.

3G. Changes in the **ocean-atmosphere** system can result in changes to the climate that in turn, cause further changes to the ocean and atmosphere. These interactions have dramatic physical, chemical, biological, economic, and social consequences.

Explain each of the above three concepts.

📖 **Resource:**

Ocean Conservancy: How Does Carbon Pollution Impact Our Ocean

Discuss:

• What are the 5 ways that cutting carbon pollution will help the ocean?

ACTIVITY 8.5— The 8 Scientific Practices: *"Allow Me to Explain!"*

The *Next Generation Science Standards* identify 8 Scientific Practices used by scientists, teachers, and students. The sixth one is **Constructing Explanations and Designing Solutions:**

A scientific explanation articulates how or why a natural phenomenon occurs and supports any explanations with evidence and scientific ideas.

We learned about observing natural *phenomenon* back in ***Activity 1.8***. And we learned that: "Scientific *phenomena* are occurrences in the natural and human-made world that can be observed and cause one to wonder and ask questions."

Here are some excellent exercises in observing different phenomena in the ocean and constructing an explanation for each. These exercises were developed by a team of science teachers in San Diego, working with experts from UCSD and the Scripps Institute of Oceanography.

Create 5 or 6 teams and allow each team to select an activity that they would like to investigate. (Don't worry about the target grade level.) Follow the directions. Prepare a presentation for the whole class, in which your group will share its findings, ideas, solutions, questions, and explanations.

• Ocean Noise Pollution Impacts Martine Mammals

• During extreme weather events, species are found off the California coast that are not normally present

• Humans are impacting the climate

• The amount of light affects the types and distribution of animals in the ocean

• The size of most plastic in the Great Pacific Garbage Patch is smaller than 1 cm2

• Removal of sea otters from the kelp forest ecosystem may result in an urchin barrens.

📖 **Resource:**

Here are some more Examples of Phenomenon directly related to Environmental Literacy. These were developed by California educators during Environmental Summits held throughout the state.

ACTIVITY 8.6— The Six Sector Solution

Research the "Six-Sector Solution," developed by the United Nations Environment Program, describes how carbon emissions can be significantly reduced in six key sectors: 1.energy, 2.industry, 3.agriculture and food, 4.forests and land use, 5.transportation, and 6.buildings and cities.

Develop a chart that describes strategies that have been developed within each sector.

• Are these solutions only for one region?
• What can we learn from the innovative ways that countries are addressing planet warming?
• Are these solutions likely to achieve the goal of decreasing global warming?

📖 **Resource:**

• Five Priorities for a Sustainable Ocean Economy

ACTIVITY 8.7— A Climate Plan

Review these 3 Definitions:

Mitigation – countering the effects of climate change – involves **reducing** the flow of heat-trapping greenhouse gases into the atmosphere, either by minimizing the sources of these gases (for example, the burning of fossil fuels for electricity, heat, or transport) or enhancing the "sinks" that accumulate and store these gases (such as the oceans, forests, and soil).

Adaptation – adapting to life in a changing climate – involves **adjusting** to actual or expected future climate conditions. The goal is to reduce our risks from the catastrophic results of climate change (including sea-level rise, extreme weather events like storms and floods, or food insecurity). It also includes making the most of any potential beneficial opportunities associated with climate change (for example, longer growing seasons or increased yields in some regions).

Climate resilience is the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to the climate. Improving climate resilience involves assessing how variables in the climate could alter current, climate-related

risks and developing a clear strategy to survive any event with a minimum loss of life or property.

Communities are beginning to address climate change through these three themes. Many have developed contingency plans for earthquakes, fires, floods, extreme heat, etc.

Develop A Plan:

• What climate events are most threatening to your school, your neighborhood, and your community?

• Does your school and/or your community have an emergency plan for natural disasters related to the climate? Does it address strategies for mitigation, adaptation, and climate resilience?

If not, develop one.

• Get a copy of those emergency plans and review the recommendations. Do they take into account worst-case scenarios?

• What are your recommendations, based on what you have learned, for how best to survive whatever Mother Nature brings your way?

ACTIVITY 8.8— Climate Policies of the United States

The government of the United States can't solve the climate crisis alone. But there is a lot they *can* do.

Over the last few decades, the United States has been both a roadblock and a world leader in pursuing climate change policy. The current Biden administration has pledged to significantly reduce greenhouse gas emissions by 2030, develop pollution-free electricity by 2035, and achieve net-zero emissions economy by 2050. And that's not all.

• Read about the recommendations from The National Climate Task Force on the actual webpage of the White House:

--Take Action in your Community
--Tackling the Climate Crisis
--Reducing Emissions and Accelerating Clean Energy
--Advancing Environmental Justice and Empowering Workers
--Strengthening Climate Resilience
--Rally Global Peers

Read the Global Climate Policies: the 2030 Summits

If you could advise our elected leaders, (and, by the way, you can!) what would you recommend they push harder for… and what do you consider to be less important?

Group Activity:

After spending some time researching the key actions taken by the Biden Administration, "put your money where your mouth is!"

Create a box for each of the 6 elements of the White House Climate Policy listed above. Give each student $100 in play money. Based on their own research and values, ask them to spend their hundred dollars on the efforts that they support the most. (For example, they can spend $75 on *environmental justice* issues and distribute the rest equally. Or they can put it all towards one initiative.)

Count up the dollars in each of the six boxes and write the amounts on the whiteboard. What do these votes tell us about students' priorities in this class?

ACTIVITY 8.9— Be the Change

Students do not have to wait for their parents, their teachers, their community or their government to invite them to the table to advocate for climate justice.

The organization called *Our Climate* **empowers young people to advocate for the science-based, equitable and intersectional climate justice policies that build a thriving world. We engage and train youth from affected communities and groups to participate in broad and diverse advocacy coalitions. Together, we build deep partnerships, mobilize, and center those most impacted by climate change to dismantle systemic oppression and achieve systemic change.**

Explore the *Our Climate* website. What kinds of actions and activities have they been involved in? What major initiatives do they keep an eye on? What are the declared values of the Our Climate organization? How do they influence elected leaders?

• How can you get involved and connected?

• Read these aspirations and goals from young leaders throughout the world: Young Leaders Sustainable Development Goals

• Imagine being recognized by the United Nations for this report. What story would you like to tell? What is your dream to help your community? What would you have to do to turn that dream into reality? What's stopping you from being a force for positive change?

ACTIVITY 8.10— The Aspen Plan

In 2021, The Aspen Institute published their *K-12 Climate Action Plan*. In it says:

"To date, the education sector has yet to establish its role in addressing climate change, and large-scale climate solutions too often overlook the role education can play."

Find the **K-12 Climate Action Plan** and compare their recommendations with what you are doing in your school district.

Do your science classes go far enough?
Do the NGSS go far enough?
What role should the education system play in addressing climate action?

The New Jersey Plan:

The state of New Jersey has become the first state in the US to mandate Climate Change Education in grades K-12. They focus on problem solving, student agency, ideas, and innovations—not doom and gloom!

The New Jersey Student Learning Standards (NJSLS) are designed to prepare students to understand how and why climate change happens, the impact it has on our local and global communities and to act in informed and sustainable ways.

Why only New Jersey? Why not California?

• **New York Times:** Penguins in Your Fridge? These 7-Year-Olds Have Climate Solutions
• New Jersey Student Learning Standards

Create a presentation on Climate Change for the educational leaders at your school. What is your argument for why Climate Change should be taught at every grade level in your school or district? Where is your data? Where is your passion?