Thermal Energy & Climate Change

Teacher Lesson Plan

Part 1: Climate Change & Literature

Background:

For years, climate change has been a controversial issue. In this lesson, students will become familiar with the science surrounding this term. It has be studied throughout the world and its effects influence the lives of people in all countries. The Paris Climate Agreement was signed by 195 countries in 2016 to work together to address the complex issue.

The books are an introduction for your students about climate change. These books were chosen because they include:

- A grade-level appropriate introduction to climate change.
- The scientific causes of climate change.
- The impact individuals and communities can have on climate change.

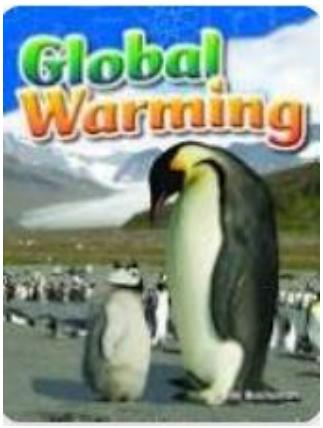
Global Warming is a short introduction to the science of climate change and its impact around the globe. While *The Confounding Case of the Climate Crisis* is a work of fiction, the main characters time travel to meet with real scientists and people are affected by climate change.

Because climate science is rapidly evolving, OEP has provided digital resources on our website focusing on specific details about climate change and its effect on the atmosphere, water, weather and agriculture. It is also important for students to know that in addition to penguins being challenged with the changes in climate, so are we in Ohio. The EPA bulletin "What Climate Change means for Ohio" has been included in your curriculum.

Objectives:

1. There is a difference between climate and weather.
2. The atmosphere around the Earth acts like a greenhouse preventing the heat from escaping into space.
3. Greenhouse gases (carbon dioxide, methane, nitrous oxide and water vapor) are accumulating at a faster rate causing the global average temperature of both air and oceans to rise.
4. Some of the causes of global warming include the increase burning of fossil fuels, deforestation and farming.
5. The effects of increased temperatures include extreme weather, melting of ice caps and permafrost, loss of habitat and species.
6. Problems for humans include droughts, floods, wildfires, change of coastlines and changes in agriculture.
7. Student's choices and have an impact on climate change.

Global Warming by Shelly Buchanan



Key Vocabulary:

- Atmosphere – the mass of air that surrounds the Earth.
- Carbon Dioxide – a gas that is produced when animals (including people) breath out or when certain fuels are burned.
- Climate – the usual type of weather a in a place over a long period of time.
- Fossil fuels – natural substances made by the remains of ancient plants and animals buried within the Earth.
- Greenhouse effect – the natural warming of the Earth's atmosphere.
- Greenhouse gases – various gases including water vapor, carbon dioxide, and methane that trap heat in the Earth's atmosphere.
- Industrial Revolution – a rapid change in the economy marked by the introduction of power machinery and manufacturing. The use of fossil fuels begins to increase.
- Permafrost – an underground layer of soil that stays frozen for two or more years.
- Renewable energy – natural energy sources that can be replaced or recycled by nature within one's lifetime.
- Weather – the state of the atmosphere in a time and place.

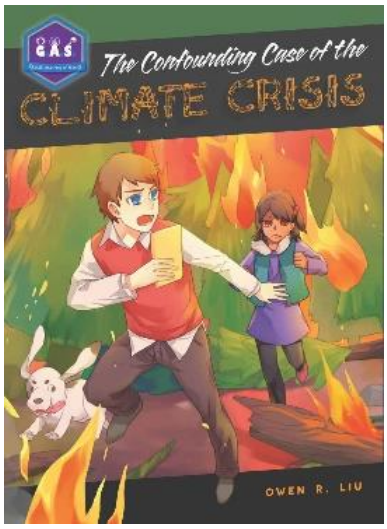
Book Talk:

Think about how often the weather changes each day. It could be cool in the morning, rain in the afternoon and then steamy hot in the evening. Are there patterns to the weather? What's the difference between weather and climate? Has it changed over the last one hundred years? The terms climate change and global warming seem to be all over the news. What exactly do those terms mean? Are the effects happening here? Let's begin to get the scoop by reading the book *Global Warming*.

Read *Global Warming*

- Before reading the book, pass out discussion questions to students. Have students pre-read the questions to get an idea of what they should be listening for while you read.
- While reading book, students answer discussion questions.
- Give time to complete questions after reading.
- Discuss answers to questions.
- Additional Ideas for Discussion Questions:
    - If the entire page of questions is too much for your students, consider breaking up the questions, assigning each student 1-2 questions to answer while you read.
    - When you are done reading have students find someone with the SAME question and meet to discuss their answers, looking for similarities and differences in their thinking
    - Likewise, you may choose to have students find someone with a DIFFERENT question and meet to share their answers.

The Confounding Case of the Climate Crisis by Owen R. Liu



Note: The two main characters time travel to visit leading scientists over the last 100 years researching climate science. They also visit places already impacted by climate change. While the two main characters are fictional, the scientists and locations they visit are real.

A separate teacher guide of discussion questions for the book is included with this lesson.

Book Talk:

Imagine going on a field trip to a greenhouse. What would you expect to see? How would it feel inside? You wouldn't expect a strange person to show up talking about carbon dioxide and conspiracies. And what has happened to your teacher? In this story you'll meet Anita and Benson, the main characters that experience all these things.

On a school field trip to a greenhouse, Anita and Benson find themselves face-to-face with a blue-haired guy from the future. They have been recruited by Quarkum, from the Galactic Science Academy, who offers them a mission. With the help of a time travel device, the students are to investigate the origins and effects of climate change. By visiting scientists and people all over the world, they learn about the science of climate change and its impact around the world. Use the evidence you discover with Anita and Benson to understand and explain this complicated concept. At the end, you will receive a mission of your own. Good luck, scientists.

Read *The Confounding Case of the Climate Crisis*

- Before reading the book, review the teacher discussion questions. The questions include both science and ELA standards. The questions are broken into segments by chapter. ELA standards are highlighted in **red**. Science standards are highlighted in **green**.
- While reading book, students answer discussion questions. Students could record their responses in a science or writing journal.
- Give time to complete questions after reading.
- Discuss answers to questions.

Part 2: Climate Change Activities

Activity 1-How Does the Greenhouse Effect Work

Materials:

2 thermometers	2 plastic cups
Plastic wrap	2 cups of soil
Rubber band or tape	Student Worksheet

Procedure:

1. Fill each cup with 1 cup of soil. You want to have the same amount of soil in each cup.
2. Place the thermometer in each cup one inch deep into the soil. You can lean it against the side of the cup.
3. Cover one cup with plastic wrap. Secure with a rubber band or tape.
4. Take a starting temperature and record it on the chart.
5. Place the cups next to each other in the sun.
6. Record the temperature every 15 minutes for one hour.
7. Calculate the temperature change on the student worksheet.

Activity 2-Take Action

- Distribute **Climate Change Scorecard** or visit the online **Carbon Footprint Calculator.**
- Discuss which activities students can choose to do.
- When students become aware of the significance of their actions, change can occur. Challenge students to complete the scorecard and discuss what they and their families can do.