Impacts and Solutions

» Essential Question: How is climate change affecting Earth’s environment and people?

» Materials: ¼ measuring cups, modeling clay, clear containers (approximately 2¼ cups in size), water, permanent markers, rulers, research books and Internet access, paper, pens or pencils

» Activity Sheets: “The Big Meltdown” and “Take Action!”

» Time Required: 40 minutes, plus homework

» Background Resource: “Be a Part of the Solution”—epa.gov/climatestudents/solutions/index.html

LEARNING OUTCOMES

Students will be able to:

1. Describe some of the effects of climate change on people and the planet.
2. Explain the connection between climate change and human health.
3. Discuss ways people are working to combat climate change.

DEMONSTRATE THE CONCEPT

Ask students if they think melting ice leads to rising sea levels. Hand out Activity Sheet B: “The Big Meltdown”

1. Pack modeling clay into a ¼ measuring cup. Turn the measuring cup upside down to remove the clay so it keeps its shape. Set the clay in a clear cup and label it “ice on land.”
2. Label the second cup “ice on water.” Add ¼ cup of water to each cup. Draw a line on the outside of the cups to mark the starting water level.
3. Place an ice cube on top of the clay in the first cup (make sure it stays balanced on the clay and doesn’t slide into the water). Add an ice cube to the water in the second cup. Allow the ice to melt and observe what happens. Mark the new water levels in the cups.

EXPLORE THE SCIENCE

Discuss what students think the results of the activity indicate about rising seas. Explain that the North Pole, located in the Arctic, is covered in ice that floats on the sea. Warming temperatures due to climate change have caused the ice there to melt at an alarming rate. While this change has created problems for animals, such as polar bears that live and hunt on the ice, it doesn’t contribute to sea-level rise. Floating ice displaces an amount of water equal to its weight, so when it melts it doesn’t add volume to the world’s oceans. The South Pole is also covered in ice and experiencing severe melting. But its ice lies on top of a landmass—the continent of Antarctica. As it melts, it pours into the ocean, increasing the ocean’s volume.

Ask students to consider what this information might mean for sea levels as climate change causes Earth’s temperatures to rise. Explain that over the past century, global sea levels have gone up by about seven inches and continue to rise. This could pose a threat to millions of people living in low-lying coastal communities in the future.

Ice also reflects sunlight back to space, while ocean waters absorb sunlight. Decreasing polar ice means oceans will warm up even faster. As its temperature increases, water undergoes thermal expansion, taking up more space and boosting sea-level rise.

Rising seas are just one of the negative impacts of climate change. Across the globe, ecosystems are struggling with problems caused by a warming world. To find out more, have students visit: epa.gov/climatestudents/impacts/index.html

COMPLETE THE ACTIVITY

Have students delve into the link between climate change and health. Climate change can cause health hazards for humans by lengthening allergy seasons and reducing air quality, which can lead to increased asthma attacks; affecting crop growth and the availability of food; increasing droughts and reducing access to drinking water; and allowing disease-spreading insects to thrive. All of these hazards have a significant impact on children, whose growing bodies are more vulnerable to environmental changes.

Organize students into groups and assign each group one of the above climate-related health topics. Have them research their issue and use the information to design a flowchart that clearly demonstrates the chain of events triggered by climate change that leads to human health impacts. Have students add a sidebar that includes information on why children are especially vulnerable to climate change.

APPLY THE KNOWLEDGE

Explain that people are using many different approaches to lessen the impact of climate change. Some are working to rely less on fossil fuels or reduce their energy use. Others are helping those already being affected by climate change hazards.

Discuss the following solutions people have devised to confront climate change:

• Fuel-efficient school buses: midwestenergynews.com/2012/08/16/illinois-teens-invention-helps-school-buses-run-more-efficiently
• Floating schools for rising seas: nytmsr/1BJakm
• Energy-generating floors: csbnews.com/news/students-using-feet-to-power-their-high-school

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Distribute Activity Sheet C: “Take Action!” to student groups. Instruct students to choose a climate change–related issue and develop an action plan to address the problem. Explain that they’ll then create a multimedia presentation to showcase their solution.

Family Connection: As homework, have students share their “Take Action!” climate change solutions with their families. They should ask for help to implement their action plan or to get involved in an established stewardship project that supports their cause. As an added incentive, explain that students will be given extra credit if they document their efforts and create a website or social media account to share their “Take Action!” ideas with others.

ADDITIONAL RESOURCES

- National Climate Assessment: nca2014.globalchange.gov
- Climate Change Threats and Impacts: nature.org/ourinitiatives/urgentissues/global-warming-climate-change/threats-impacts
- Effects of Climate Change: worldwildlife.org/threats/effects-lying-coastal-communities/
- Surging Seas: seallevel.climatecentral.org
- Health Impacts of Climate Change: niehs.nih.gov/research/programs/geh/climatechange/health_impacts/index.cfm
- Climate Effects on Health: cdc.gov/climateandhealth/effects
- Coping With Climate Change: pbs.org/newshour/tag/coping-with-climate-change
The Big Meltdown

Rising sea levels are one of the biggest threats posed by climate change. As Earth’s average temperature increases, ice covering places, such as the Arctic and Antarctica, is beginning to melt. Some of that meltwater can add to the ocean’s volume and cause sea levels to rise. The rising water can inundate coasts and low-lying islands. This is already having a drastic effect on some communities around the world. As a class, you will complete an experiment to see how melting ice covering land and floating on water contributes to sea-level rise. Record your observations below.

Before the Experiment
1. Write a research question that clearly states what you are trying to determine with this experiment.

2. Write a hypothesis to state a likely outcome of your research.

During the Experiment
Record the data you collect in the table below.

<table>
<thead>
<tr>
<th>Cup</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 minutes</td>
</tr>
<tr>
<td>Ice on Land</td>
<td></td>
</tr>
<tr>
<td>Ice on Water</td>
<td></td>
</tr>
</tbody>
</table>

After the Experiment
1. What real-world scenario does the ice-on-land cup represent? The ice-on-water cup?

2. What was the rate at which the ice in each cup melted? Which cup saw the greatest water-level rise? Was your hypothesis correct?

3. Which will have the greatest effect on future sea-level rise: melting sea ice or melting land ice? Explain your answer based on the outcome of your experiment.

Take It Further  Warmer temperatures on Earth are also causing our oceans to heat up. The increasing temperature of our oceans is a contributing factor to sea-level rise. Why might that be? (Hint: What happens to water molecules when they heat up?)
Take Action!

Most scientists consider a rise in human-generated greenhouse gases as the main contributor to climate change. While the scale of this problem might seem overwhelming, there are ways people can make a difference. Reflect back on what you've learned about the causes and effects of climate change. Was there a particular aspect of this topic that really got you thinking or motivated you to make a change in your own life? Now's your chance to be part of the solution. Follow the steps below to find a way to address a specific climate change–related problem, then create an action plan to put your idea into motion.

Step 1: Choose an Issue
In a sentence or two, describe the climate change–related issue you’d like to address:

Step 2: Research It
On a separate sheet of paper, write down what you already know about this issue, as well as things you’d like to find out more about. Then use the Internet or library to dig up all the information you can. (Remember to cite the sources you use as references.)

Step 3: Brainstorm Solutions
Write down three ways you could address this issue. They should be realistic and fact-based. For example, could you invent a new gadget, create an environmental program, or start a campaign to encourage people to change their behaviors to help solve the problem? Vote as a group to choose the best solution, keeping in mind any downsides or challenges to its implementation.

Step 4: Create an Action Plan
On a separate sheet of paper, write down the steps you’ll need to take to put your solution into action. What types of resources will you need? Will you need help from other people or organizations? How will you raise awareness about your idea?

Step 5: Share Your Idea
Create an informative and inspirational 10-minute multimedia presentation to share your solution with your class and others. It should introduce the topic, provide background information, describe your solution, explain why it would be effective, and detail the steps necessary to turn your idea into a reality.

Presentation Tips:
• Engage your audience by including multimedia aids, such as video, audio, and graphics.
• Use statistical evidence to support claims, as well as to illustrate the importance of your chosen issue or the feasibility of a solution.
Lesson 2 Rubric: Multimedia Presentations

Use the rubric below to assess students’ multimedia presentation from the “Apply the Knowledge” section in Lesson 2.

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>1—INADEQUATE</th>
<th>2—DEVELOPING</th>
<th>3—PROFICIENT</th>
<th>4—EXCELLENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>Unprepared for presentation. Hasn’t researched and lacks understanding of the topic.</td>
<td>Has done some research. Shows some inaccuracies in knowledge of the topic.</td>
<td>Has adequately researched and is knowledgeable about the topic.</td>
<td>Has researched thoroughly and shows a clear understanding of and is comfortable speaking about the topic.</td>
</tr>
<tr>
<td>Content</td>
<td>No clear solution is presented. Information, findings, and evidence are not factual. No sources are cited.</td>
<td>A solution is presented in a confusing manner and implementation challenges are not addressed. Not all information, findings, and evidence are accurate. Few sources are cited.</td>
<td>Conveys a clear solution, but implementation challenges are not addressed. Information, findings, and supporting evidence are given, but sources are not always cited.</td>
<td>Conveys a clear solution while addressing implementation challenges. Presents appropriate information, findings, and evidence to support ideas. Several sources are cited.</td>
</tr>
<tr>
<td>Presentation</td>
<td>Speaks inaudibly so that the audience can’t hear or understand the presentation. Doesn’t make eye contact and reads mostly from notes. Mostly uses informal or inappropriate language.</td>
<td>Speaks at an inconsistent volume or speed so that the audience has difficulty hearing or understanding presentation. Presenter heavily relies on notes. Frequently uses informal language.</td>
<td>Speaks clearly and loudly for most of presentation. Maintains eye contact most of the time but frequently refers to notes. Mostly uses formal and appropriate language.</td>
<td>Consistently speaks clearly and loudly while making eye contact with the audience and seldom using notes. Uses formal and appropriate language.</td>
</tr>
<tr>
<td>Visuals, Graphics, and Audio</td>
<td>Doesn’t include interesting or relevant sources of media. Information presented in sources is inaccurate or inappropriate for audience.</td>
<td>Minimally includes media or media doesn’t add constructively to presentation or support the topic.</td>
<td>Integrates some credible sources of media into presentation to support ideas and findings and add interest.</td>
<td>Strategically integrates media in a variety of formats to enhance understanding of findings, reasoning, evidence, and to add interest. Each source used is credible and the information accurate.</td>
</tr>
<tr>
<td>Organization</td>
<td>Presentation is confusing and difficult to follow. There is no clear organization. The development, substance, and style are not appropriate for the presentation’s purpose, audience, and task.</td>
<td>Speaker’s reasoning is difficult to follow and there is limited organization of information. The presentation’s development, substance, and style rarely align with its purpose, audience, and task.</td>
<td>Listeners can follow most of the speaker’s reasoning. Thought has been given to the order of information. For the most part, the presentation’s development, substance, and style align with its purpose, audience, and task.</td>
<td>Listeners can easily follow the line of reasoning. Ideas are presented in a well-thought-out, logical sequence. The presentation’s development, substance, and style align with its purpose, audience, and task.</td>
</tr>
</tbody>
</table>