# of Days | 3
---|---
Prior Knowledge | Students will have heard of greenhouse gases. They probably will know very little about energy balance.
Lesson Objective | Students will be able to identify greenhouse gases and their sources. Students will explain the role these gases play in the Earth's energy budget.
Language Goals/Demands | Reading 2.5
Listening 1.1
Speaking 2.2 b and c
Lesson Assessment | Concept map on days 2-3, formative - connection of sources and sinks, Lab activity
(Benchmarks or Standards) | Earth Science 4c and 4d, Investigation 1 a, b, c, d, and k
Materials Needed | Powerpoint, Materials for greenhouse gas effect activity; Resonance models with tennis balls, etc.; Gas Files Activity

<table>
<thead>
<tr>
<th>Time</th>
<th>Learning Task or Activity</th>
<th>Method &amp; Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td><strong>INDIVIDUAL SEAT WORK</strong></td>
<td></td>
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<tr>
<td>3 min</td>
<td>BW: Study for the Quiz over LP 1 &amp; 2 Share/review last night's homework</td>
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</table>
| 15 min | Quiz | **INDIVIDUAL SEAT WORK**
3.1.2 QUIZ |
| 7 minutes | What do you already know? What are the greenhouse gases? Where do they come from? How do they work? | **KWL Quiz**
See 3.1.3 Greenhouse Gases Slide #2
Activating prior knowledge. Before naming the greenhouse gases, ask what students already know. |
| 10 minutes | Greenhouse Gas Presentation
- If the amount of energy that comes in is the same amount of energy that goes out, how can our planet stay warm?
- The answer is greenhouse gases. | **LECTURE/DISCUSSION**
See 3.1.3 Greenhouse Gases Slides #3-5
Use 3.1.4 Student Notes Handout |
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<tr>
<td>20 min</td>
<td>Resonance Model Demonstration - Show students different models of atmospheric compounds and how they resonate. Have students connect the different wavelengths with resonance. What would happen without greenhouse gases? Goldilocks slide.</td>
<td>LECTURE/DEMONSTRATION</td>
<td>See 3.1.3 Greenhouse Gases Slides #6-10 DEMONSTRATION - Follow 3.1.5a Task Card. Collect data by group on the board. Use 3.1.5 for instructions to make models. VIDEO: Resonance by Scott Denning <a href="http://www.youtube.com/watch?v=AlBk0pGV_BQ&amp;feature=related">http://www.youtube.com/watch?v=AlBk0pGV_BQ&amp;feature=related</a></td>
</tr>
<tr>
<td>HW</td>
<td>Students are to read the Carbon Dioxide and Greenhouse Effect and create 5 questions and an answer key.</td>
<td>HOMEWORK</td>
<td>3.1.6 Reading on Carbon Dioxide and the Greenhouse Effect</td>
</tr>
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</table>

### Day 2

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<thead>
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<tbody>
<tr>
<td>3 min</td>
<td>BW: What would happen if there were no greenhouse gases?</td>
<td>INDIVIDUAL SEAT WORK</td>
<td></td>
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<tr>
<td>35 min</td>
<td>The Greenhouse Gas Effect Activity and Poster - Students should work in groups to set up their labs. If they are successful at trapping CO₂ they should see a change in temperature in about 20 minutes. - While waiting/collecting data, students create a Greenhouse Effect Posters. Students work individually or with partners to create a poster to illustrate the path of sunlight as it radiates to the Earth (include pictures of Sun, Earth and representation of the terms radiation, reflection, absorption, and greenhouse gases).</td>
<td>HANDS-ON LAB</td>
<td>3.2.1 Greenhouse Gas Lab – written directions Greenhouse Effect Poster supplies</td>
</tr>
<tr>
<td>7 min</td>
<td>Debrief Lab and Discussion - Debrief the lab, discuss the greenhouse effect and how the gas in the atmosphere does cause an increase in temperature.</td>
<td>DISCUSSION/LECTURE/Q&amp;A</td>
<td>See 3.1.3 Greenhouse Gases Slides #10-11</td>
</tr>
<tr>
<td>5 min</td>
<td>Energy Balance Diagram or Review of Resonance - Teachers and students will step through the different parts of the energy balance diagrams with students providing explanations for each of the arrows. - Students continue working on posters.</td>
<td>DISCUSSION/LECTURE/Q&amp;A</td>
<td>See 3.1.3 Greenhouse Gases Slides #12 or 13 Students continue working on the posters and share with classmates</td>
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<tr>
<td>5 min</td>
<td>Concept Map - Students will add to the concept map. Hand out the new words they should add to their maps.</td>
<td>INDIVIDUAL SEAT WORK</td>
<td>Use 3.2.2 Concept Map Homework</td>
</tr>
<tr>
<td>HW</td>
<td>Work on concept map</td>
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</table>
| Day 3 | 3 min | BW: What do you think are the sources of greenhouse gases?  
- Check concept maps | INDIVIDUAL SEAT WORK |
| 7 min | Introduction to today's activity: Sources and Sinks - Thought question about bathtub. | THINK/PAIR/SHARE  
Use 3.3.1 Bathtub Thoughts Handout |
| 25 min | Gas Files Activity  
- Students look at data and graphs to determine the quantities and sources of the different greenhouse gases  
- Examples will deal with CO₂, methane, nitrous oxide, and water vapor | GROUP WORK  
Use 3.3.2 Gas Files Activity |
| 15 min | Mitigation Strategies  
- Show the wedge diagram that will be used with the final assessment showing increases in greenhouse gases.  
- Talk about three or four wedges - ways to mitigate more carbon emissions | LECTURE/NOTES  
3.3.3 Mitigation Strategies Slides  
Use 3.3.3A for student notes during the presentation  
3.3.5 Pictures of Power Plants OPTIONAL |
| HW | Concept Map  
- Students will add to the concept map. Hand out the new words they should add to their maps. | HOMEWORK  
3.3.4 Concept Map Homework |