Climate Change: Passing Gas

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Subjects: Social Studies
Science

Grade levels: Grades 4–7

Brief overview
In this lesson, students engage in an experiential learning activity, acting out the accumulation of gases in the Earth's atmosphere. Through this and related activities, the lesson reinforces understanding of the impact of human behavior on climate change.

Themes
- environment
  - environmental information and education
  - addressing climate change.

Time required
90 minutes

List of required materials and/or equipment
- information for the teacher (Appendix one)
- checklist of human actions that have an impact on carbon gas levels (teacher created, optional)
- chart paper and marking pens or large plastic sheets and dry erase markers (optional)
- Climate change: passing gas warm up (Appendix two; one copy for each student)
- Climate change: passing gas worksheet (Appendix three; one copy for each pair of students)
- answer key possibilities (Appendix four)
- gymnasium or other large space
- Thirty balls of the same size (the larger the ball, the higher the difficulty)
- scrap paper.

Procedure
Note that this lesson should be taught after the students have some grasp of climate change.

1. For homework, have students complete the Passing Gas warm-up worksheet (Appendix two).

2. In the classroom, review the idea of the greenhouse effect and climate change. See *www.davidsuzuki.org/Climate_Change/Science/Greenhouse_Gases.asp*. Discuss the three main gases in the Earth's atmosphere that contribute to the greenhouse effect (carbon dioxide, methane, and nitrous oxide).

3. Brainstorm human actions that have an impact on the level of these gases within the earth's atmosphere.

   Variation: Instead of brainstorming with the class as a whole, divide students into small co-operative learning groups of three or four students and assign and review group roles and responsibilities (i.e. a facilitator to ensure that the task is correctly finished within the allotted time and that all group members contribute; a recorder to record highlights of group discussion on chart paper or large plastic sheets; a reporter to report out to the class as a whole on behalf of the group; an encourager or clarifier). Provide each group with a checklist of human actions that have an impact on carbon gas levels in the earth's atmosphere. Have groups review this list and then create a list of the actions they take as part of their typical daily routines.

4. Debrief. Identify and discuss routines/actions that benefited or harmed the environment. If students are working in co-operative learning groups, have groups post the notes written by their recorders (on chart paper or large plastic sheets) in locations visible to the entire class, and ask reporters to report out on behalf of their groups, using the notes as visuals.

5. With the class as a whole, summarize the actions that have been identified (adding to the list as appropriate) and assign *gas action* points to the various actions (i.e. plant a tree is = - 4 carbon dioxide points; garden with many chemicals = + 3 nitrous oxide).

6. Copy these actions with their assigned gas actions points onto separate pieces of paper.

7. Explain the Passing Gas game:
   The object of the game is to act out how human actions affect the balance of **greenhouse gases** in the **atmosphere**. In practice, one group of students rolls several balls of **solar energy** through another group of students. The aim is to have only five balls (or another magic number) kept behind the second group of students, and to allow other balls to bounce back out.
   In each round, the density of the greenhouse gases in the atmosphere varies depending on which **gas action** is read.

   a. Divide the class into two groups: Team Sun and Team Atmosphere. Team Atmosphere should be about two times as big as Team Sun.

   b. Within Team Atmosphere, delegate some students to be carbon dioxide, methane, and nitrous oxide.

c. Assign some members of Team Atmosphere to stand in a line about three metres from a designated gym wall. This line will represent the earth's outer **atmosphere**. Assign the remaining members of the team to stand along the wall. They will represent the earth. At the beginning of the game, the students on the outer atmosphere line should stand far enough apart that they are not able to touch one other with their arms extended.

d. Team Sun is to stand in a line a few metres away from the atmosphere. Members of this team should have a ball in each hand.

e. When the teacher calls, "Shine!" members of Team Sun are to roll balls towards the atmosphere.

f. Team Atmosphere's sole function is to keep as many balls within the atmosphere as possible. They do this by using one hand only. They cannot move their feet.

g. After the balls have slowed, they class will count how many balls are in the atmosphere and how many have escaped back into space.

h. After a few rounds, the class will average the numbers to determine their magic number, which is the number where the earth's climate is stable.

i. At this point, the teacher or a special helper is to read out one of the Gas Action/Assigned Point Value notes recorded earlier. This corresponds to how many students leave the earth (gym wall) and join the atmosphere. This makes keeping the balls in the atmosphere easier, because there are more hands to block the balls' escape into space. This also makes the earth warmer, as every ball represents heat from the sun.

8. Go to the gym and play.
   a. Play several rounds reading one gas action each time to exemplify how human choices affect the greenhouses gases and therefore climate change negatively and positively.
   b. End the last round on a positive note so as to foster a feeling of empowerment.

9. Debrief in the classroom. Discuss the importance of realizing the impact of our actions, and how the smallest change in our behaviour can make a difference. (This can be reinforced in the game.) Discuss the reasons these actions are taken or not taken (e.g. comfort, ease, tradition, convenience, education). Emphasize that we don't need to be perfect or give up if we feel overwhelmed. We can change for the better little by little.

10. Have students complete the climate change passing gas worksheet (Appendix three).

11. Review responses with the class as a whole. (See Appendix four, Answer key possibilities). Collect student worksheets for assessment.

12. Ask students to think individually and quietly and then commit to one action. Write two copies. Teacher collects one.

13. After a week/month, return commitments to students as reminders and ask them to reflect on their progress in meeting their commitments. Discuss their successes and difficulties in achieving their commitments. Have them revise as necessary, adding strategies to achieve success.

Assessment strategies

1. Review student responses on the Climate Change: Passing Gas worksheet pages to assess both individual and class learning. Draw on this information in planning future sessions in order to deepen student understanding and commitment.

2. If your students have worked in cooperative learning groups, have each group assess its level of participation. Assessment forms may be downloaded from:
   - *bctf.ca/uploadedFiles/Social_Justice/Programs/Global_Education/Teaching_Resources/ Methodologies/PuttingProcessToContent-Appendix3.pdf* (beginner) or
   - *bctf.ca/uploadedFiles/Social_Justice/Programs/Global_Education/Teaching_Resources/Methodologies/PuttingProcessToContent-Appendix4.pdf* (advanced)
   - Groups should try to reach consensus (you may need to review this concept) as they complete their assessment forms.
   - Upon completion, group reporters are to report out to the class as a whole. Emphasis should be placed on group goals for improvement.

Appendices

1. Information for the teacher
2. Climate change: Passing gas warm-up
3. Climate change: Passing gas worksheet
4. Answer key possibilities

Information for the teacher

Adapted from *www.davidsuzuki.org/Climate_Change/Science/Greenhouse_Gases.asp*

Climate change is largely caused by the burning of fossil fuels, but deforestation and current farming practices also have a large impact.

The greenhouse effect refers to the gases in our atmosphere that trap the sun's heat to warm the earth, like the glass of a greenhouse. Without these gases, the earth would be too cold to sustain life as we know it. However, if there is too much of these gases, the globe warms and the climate changes.
There are three main gases that affect climate change.

1. Carbon dioxide is the main contributor and is emitted through the burning of fossil fuels.

2. Methane is produced when vegetation burns, digests (feces, farts), or rots without oxygen. Large amounts of methane are produced by cattle farming, waste dumps, and the production of oil and gas.

3. Nitrous oxide is perhaps the most worrisome in that it has 310 times the global warming potential of carbon dioxide. It is released by chemical fertilizers and fossil fuels.

Climate Change: Passing Gas Warm-up

Part A

Circle one of the terms below to complete the sentence.

All Most Many Some A few None

_____ of my daily choices affect climate change.

Part B

Complete the chart below. Record how much you think your action affects climate change with a check.

Daily routine	**Really affects climate change**	**Affects climate change a little**	**Doesn't affect climate change**
Turn on the radio			
Turn on the bedroom light			
Brush my teeth			
Shower with hot water			
Eat _____ and _____ and _____ for breakfast			
Go to school by _____			

Climate Change: Passing Gas Worksheet

Discuss the following questions with your partner. Use the gym activity to help you remember. Record your answers.

1. Which actions increase carbon dioxide in the atmosphere?

2. Which actions increase nitrogen?

3. Which actions increase methane?

4. What is something that you do now that slows climate change?

5. List five ways you can help to slow climate change.

6. List two ways your family can slow climate change.

7. List two ways the school/community can slow climate change.

Answer key possibilities

These will largely depend on the initial brainstorm session.

1. Which actions increase carbon dioxide in the atmosphere?
   - driving
   - air travel
   - transportation of goods from around the globe.

2. Nitrogen?
   - using chemical fertilizers in the garden
   - eating food that was grown with chemical fertilizers.

3. Methane?
   - large pig, cow farms
   - not composting.

4. List five ways I can help slow climate change.
   - walk/bike more, drive less
   - eat/buy local to minimize transportation emissions
   - learn more about it, stay current
   - tell others
   - turn off lights: saving energy affects climate change because fewer fossil fuels are burned to create electricity
   - take shorter, less hot showers to reduce energy used to heat the water
   - eat less meat so that there is less of a need to have large farms that emit methane.

5. List two ways my family can slow climate change.
   - take local vacations
   - eat/ buy local
   - use natural gardening techniques to reduce nitrous oxide seepage into the water systems
   - recycle and compost where possible to reduce methane emissions from landfills
   - change to energy efficient appliances and light bulbs to save energy.

6. List two ways the school/ community can slow climate change.
   - recycling program
   - reduce energy use.

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