## **STUDENT GUIDE** EXPLORE 2 LESSON 10



Part 1: Our Motivation

Record what we were trying to figure out that led to this investigation.

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#### Part 2: Analyzing Greenhouse Gas Residence Time

Below is a data table that lists greenhouse gases and the amount of time they spend in the atmosphere, which is also known as residence time.

Greenhouse gas	Average lifetime in the atmosphere
Carbon dioxide	50-200 years*
Methane	12 years

Content modified from : https://www.icsusa.org/pages/articles/2010-icsusa-articles/november-2010---carbon-dioxide-the-800-pound-gorilla-that-we-have-to-talk-about.php

Analyze the data from the table above and compare the residence time and global warming potential of methane to that of other greenhouse gases.

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After looking at data about residence time for greenhouse gases, what new questions do you have? Write these in the space below.

## Part 3: Using a Model to Investigate Movement of Methane and Carbon Dioxide

In the space below, describe where you find carbon, how you think carbon moves in the environment, and the various forms that carbon takes on as it moves.

### Journey – Fossil Fuel Emissions

- 1. Around the room, there are stations that represent carbon pools that are part of the Carbon Travel Game. In this game, you will model how molecules containing carbon, such as methane and carbon dioxide, move into and out of the atmosphere.
- 2. Move to the starting station as instructed by your teacher. Working with a partner, follow the instructions on each of the station cards to determine where your carbon molecule moves.
- 3. Record this step of your carbon journey in the table below.
- 4. You must complete 10 turns. Record your data in the table on the next page.
- 5. After you are finished, draw arrows representing your movement from one carbon pool to another on the class model on the board.

### Journey – Cow Burps and Methane

- 6. Repeat the game by following the instructions on each of the station cards for methane. You must complete 10 turns. Record your data in the table on the following pages.
- 7. After you are finished, use a different color to draw arrows on the class carbon cycle to represent your movement through the carbon cycle as methane.

Complete the table below as you work through each station.

Journey – Fossil Fuel Emissions			
Number Rolled	Where is carbon now? List the pool where you currently reside	Through what process did carbon leave? List the flow or process to take you to another pool	Where did carbon arrive? List the pool where you move to

Journey – Fossil Fuel Emissions (continued)			
Number Rolled	Where is carbon now? List the pool where you currently reside	Through what process did carbon leave? List the flow or process to	Where did carbon arrive? List the pool where you move to

Complete the table below as you work through each station card.

Journey – Cow Burps and Methane			
Number Rolled	Where is carbon now? List the pool where you currently reside	Through what process did carbon leave? List the flow or process to take you to another pool	Where did carbon arrive? List the pool where you move to

Journey – Cow Burps and Methane (continued)			
	Where is carbon now?	Through what process did	Where did carbon arrive?
Number	List the pool where you	carbon leave?	List the pool where you
Rolled	currently reside	List the flow or process to	move to
		take you to another pool	

# Part 4: Using a Model to Explain Residence Times and Greenhouse Effect for Carbon Dioxide and Methane

In the space below, explain why methane and carbon dioxide have different residence times in the atmosphere.

Carbon Dioxide	Methane