



# Enhanced Fuel Recovery Model

## OPTION A: DRY ICE

### Question

How does using carbon dioxide allow additional oil and gas to be recovered from reservoirs that are slowing production?

### Hypothesis

Make a hypothesis to address the question using the following format: If (independent variable) then (dependent variable) because ...

### Materials

- 1 Mason jar lid with two ¼" holes
- 1 Mason jar lid with one ¼" hole
- 1 Empty water bottle
- 2 24" x ¼" Tubing
- 1 Piece of dry ice, about the size of an ice cube
- Assorted rocks, sand, and marbles
- 150 mL Vegetable oil or lamp oil
- 350 mL Water
- 1 Dark color of food dye
- Silicon sealant
- Tongs
- Gloves
- Safety glasses
- Tape

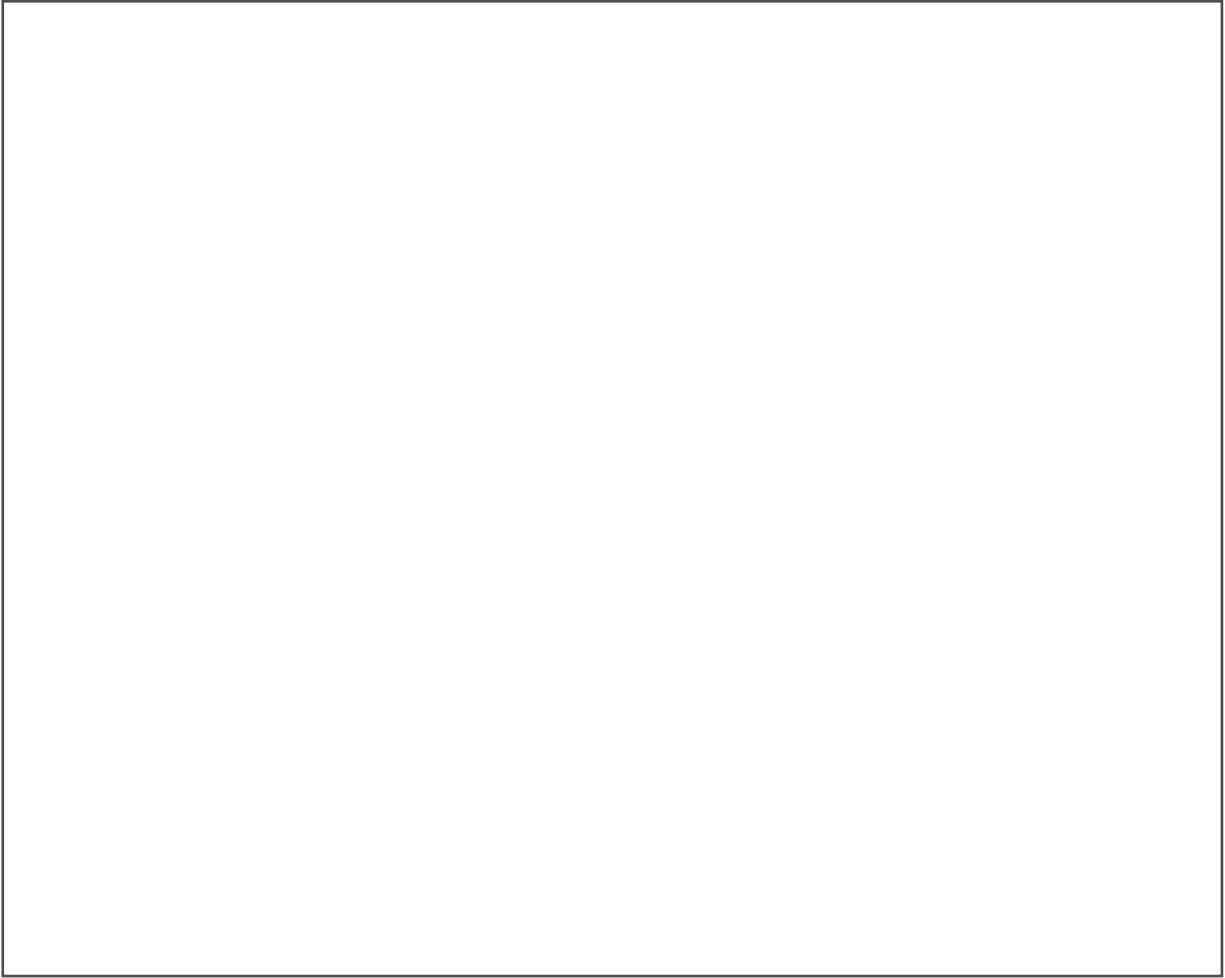
### Procedure

1. Review *Dry Ice Safety* rules with your teacher and your group members.
2. Put one piece of tubing through the lid with two holes. Slide the tubing all of the way down into the bottom of one jar. Tape the tubing to the inside of the jar to hold it in place. This jar will serve as your **reservoir jar**. Place the other end of this tube into the water bottle. The water bottle will serve as your **production bottle**.
3. Insert the second piece of tubing about 5 cm through the second hole in the lid for the **reservoir jar**. Insert the other end of this tubing about 5 cm into the lid with one hole for the other empty mason jar. The jar with one hole in the lid will serve as your **CO<sub>2</sub> injection jar**.
4. Secure the tubing in both lids with sealant. (If time permits, allow the sealant to dry prior to executing the experiment for better results.)
5. Fill the **reservoir jar** with marbles, rocks, and/or sand. Leave about an inch of open space at the top of the **reservoir jar**.
6. Add 150 mL of oil to the **reservoir jar**. This represents crude oil stuck within the rocks below ground.
7. Fill the remainder of space in the **reservoir jar** with water, being careful to fill only up to the top of the rocks/marbles/sand. Dye the water with food coloring if you desire.
8. Secure the lid with two holes on the **reservoir jar** tightly.
9. Pinch off the tubing and gently rotate and mix the **reservoir jar**.
10. Using tongs, place a piece of dry ice into the **CO<sub>2</sub> injection jar** with one tube in its lid. Secure the lid tightly and be prepared for the **production bottle** to start filling up with recovered oil and water from the reservoir.

## Observations

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Draw a diagram of your reservoir model. Describe what is happening. Where is the CO<sub>2</sub> going? Where is the oil going? How much oil were you able to recover?



## **\*\*** Conclusions

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1. How does carbon dioxide allow for enhanced hydrocarbon recovery?

2. What are some of the benefits? What are some of the challenges?