Student Worksheet:
How Black Smoker Vent Chimneys Form

The first hydrothermal vent was discovered nearly eight years after the first moon landing. The discovery of these structures on the deep ocean floor revolutionized our understanding of our planet and life on it. Biologists, chemists, geologists, and physicists continue to study these structures and how they form in order to understand their role in Earth's systems.

Experience the Phenomenon

As you watch the provided videos, fill in the chart below with at least two observations and two questions. You will discuss these as a class.

I Notice - Observations	I Wonder - Questions

Work with your group to answer the following questions.

1. How would you describe the conditions near the vents?

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2. How does the water coming out of the vent compare to the surrounding water?

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3. What do you think we know about the components of a black smoker vent and how they interact with the surrounding environment?

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4. Using all the information you have gathered, write down one way you think vent chimneys might form.

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Investigate

You will conduct an investigation to help support or fill in the gaps for your claims in question #4 above and to answer the **Driving Question:** *How do chimneys form at black smoker hydrothermal vents?*

Set-up all materials as you see in the diagram to the right.
Remember, this is a model of the vent chimney phenomenon we are studying.

Label the diagram with what each part actually represents in real life.

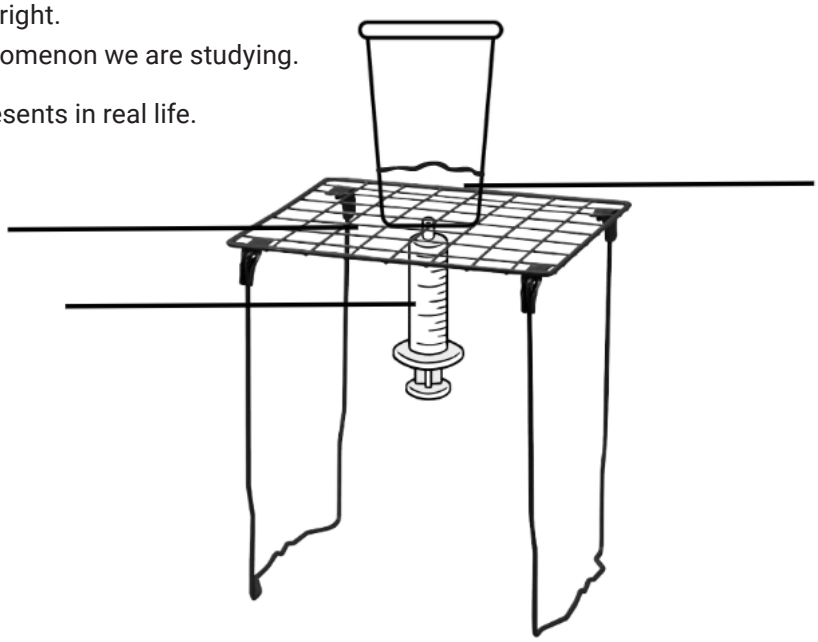

Diagram of Lab Set-up

Procedure: Preparing the saturated solutions

- In one beaker, make a saturated solution of magnesium sulfate (Epsom salt) by mixing ~1 tsp of Epsom salt with ~140 mL of distilled water.
- In the second beaker, make a saturated solution of sodium carbonate (washing soda) by mixing ~1 tsp of washing soda with ~140 mL of distilled water.
- Record your observations in the data table below.

Substance	Formula	Color/Texture	Solubility in Water	State of Matter
Epsom Salts (Magnesium Sulfate)				
Washing Soda (Sodium Carbonate)				

Combining the Two Saturated Solutions

- Use a plastic syringe to collect 10mL of the sodium carbonate solution from the beaker.
- Gently place the full syringe into the hole on the bottom of the empty, plastic cup. DO NOT push the contents of the syringe into the cup yet.
- Then, fill the empty plastic cup with all of the magnesium sulfate solution.
- Finally, gently press the syringe to expel the sodium carbonate solution into the cup with the magnesium sulfate solution.
- Observe closely as the liquid in the syringe combines with the liquid in the plastic cup.

Put the Pieces Together

Discussion Questions

5. What did you notice when you mixed the two solutions?

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_____

6. Did a physical or chemical change occur when you mixed the two solutions? Explain your answer.

_____

_____

7. What do you think is happening?

_____

_____

8. Write down the reaction formula provided by your teacher. How can this equation help explain what you observed?

_____

_____

9. After watching the videos and discussing it with the class, how would you modify the explanation you shared above to answer the question: How do chimneys form at black smoker hydrothermal vents?

_____

_____

10. Draw a diagram showing how chimneys form at black smoker hydrothermal vents.