

Name: _____ Period: _____ Date: _____

Lab: Water in Rocks?

Q. Could the water in Earth's oceans have originated from rocks?

Purpose: To observe and measure what happens when gypsum, a common mineral found in rocks, is exposed to high heat.



Gypsum and crushed gypsum.

Background:

Gypsum is a sulfate mineral commonly found on earth's surface and in the crust. Its chemical formula is $(\text{CaSO}_4 \bullet 2\text{H}_2\text{O})$, so when heat (kinetic energy) is applied to it, it should release its water from the lattice and turn into a different mineral called *anhydrite* (CaSO_4). We use this as a proxy (approximation) for what rocks from space might have gone through when they arrived on the (very hot) young Earth.

Materials Needed:

- 3g of gypsum
- Hotplate
- Mass balance
- 150mL Erlenmeyer flask
- Watch glass
- Gloves
- Tongs
- Timer

Hypothesis: If heat (kinetic energy) is applied to the gypsum, then we will see _____
_____ happen inside the flask.

Procedure:

1. Collect all of your group's materials and make sure you read through these instructions first!
→ Heat safety is very important in this lab!
2. Weigh your Erlenmeyer flask and record its mass in grams (g).
3. Tare your flask and add gypsum piece(s). Record the mass of the gypsum in grams (g).
4. Place flask + gypsum on hotplate. Carefully place watch glass on top of the flask, making sure it is stable.
5. Turn heat dial up to 9/10 (essentially, as hot as it can go). Start timer.
6. Make sure you are at least 2 ft from hotplate- it gives off a lot of heat!
7. Watch the flask for fog- record the time when you start seeing it and record below.
8. Let the crystal heat up for 10 minutes total and record any observations you can below.

Name: _____ Period: _____ Date: _____

9. After 10 min, turn hotplate off but **leave the flask on- just let it cool down slowly.**

10. While you wait to measure the final mass, do your calculations (below).

Data:

Trial #	Flask Mass (g)	Gypsum Mass- before (g)	Gypsum Mass- final (g)	Time to fog/rain (min/sec)	Observations
1					
2					
3					

Calculations:

We'll calculate the expected mass loss through the application of heat (kinetic energy) by using the known atomic masses of the elements in gypsum. Here's what you'll need:

Element	Atomic Mass
Ca (calcium)	39.92
S (sulfur)	32.07
O (oxygen)	15.99
H (hydrogen)	1.00

Plug those masses into the formula for gypsum ($\text{CaSO}_4 \bullet 2\text{H}_2\text{O}$) to get a total mass:

1) ____ (Ca) + ____ (S) + 4 * ____ (O) + 4 * ____ (H) + 2* ____ (O) = _____

Name: _____ Period: _____ Date: _____

Next we'll calculate the mass of just the 2 waters in the formula (which presumably is what we lost during the reaction of gypsum turning into anhydrite):

$$2) \quad 4 * \text{ ______ } (\text{H}) + 2 * \text{ ______ } (\text{O}) = \text{ ______ }$$

If we want to predict the % mass lost, we'll use total masses calculated in #1 and #2 to figure it out:

$$\text{Predicted \% Mass Lost: } \left(1 - \frac{\text{Gypsum total mass (\#1)} - \text{water mass (\#2)}}{\text{Gypsum total mass (\#1)}} \right) * 100 = \text{ ______ } \%$$

If your hot plate has cooled down, now you can now weigh your gypsum. Use gloves to carefully remove the watch glass from the flask, and use the tongs to measure the mass of the flask + gypsum. Using your initial flask mass, figure out your "final" gypsum mass and record in your table above.

Once you've recorded your final gypsum mass, you can now calculate your own % mass lost and compare it to the predicted above.

Here's the equation you'll use:

$$\text{Actual \% mass lost: } \left(\frac{\text{Before gypsum mass (g)} - \text{final gypsum mass (g)}}{\text{Before gypsum mass (g)}} \right) \times 100 = \text{ ______ } \% \text{ lost}$$

Trial #	Actual % Mass Lost (show your work below)
1	
2	
3	
Average	

Name: _____ Period: _____ Date: _____

Discussion Questions (please answer on a separate sheet of paper or in your notebook):

1. How did your average % mass lost compare to what you predicted? Explain.
2. Where did all the water in the flask come from?
3. What kind of changes did you observe in the gypsum itself?
4. How did your hypothesis work out? What was surprising in this experiment?
5. How does this connect to our driving question, "Where did Earth's oceans come from?"
6. What sources of error might exist in this lab?