NAME: _____ PERIOD: _____ DATE: _____

LAB PARTNERS: _____ LAB #11

TEMPERATURE/SURFACE AREA AND CHEMICAL WEATHERING

INTRODUCTION

Chemical weathering is the process by which rock material is broken down causing the minerals to change into other substances. All chemical weathering processes involve water. Carbonic acid is a weak acid that forms when carbon dioxide dissolves naturally in rain, streams, or groundwater. A common form of chemical weathering is the reaction between carbonate rocks, such as limestone and marble, with carbonic acid. In this lab, you will observe a model of this reaction. By changing the temperature of water, you can model the effect of the temperature on the rate of reaction between carbonate rocks and carbonic acid.

OBJECTIVE

1. To model how specific conditions affect chemical weathering processes.
2. To graph the data from the model and to interpret the model.
3. To predict what will happen when the variables are changed.

MATERIALS

5 – 250ml beakers
5 – Thermometers
8 – Effervescent Antacid Tablets
Stopwatch
Graph Paper
DC Heath Textbook – Earth Climates page 664.
Ice
Hot Water

PROCEDURES

1. Arrange the 5 beakers in a row. Assign each beaker a number form 1 – 5. Place a thermometer in each beaker. Each beaker should contain 200ml of water. The water temperature in each beaker will need to be adjusted to match the following:

Beaker 1	0 – 10°C
Beaker 2	10 – 20°C
Beaker 3	20 – 30°C
Beaker 4	30 – 40°C
Beaker 5	40 – 50°C

2. Begin with Beaker 1. **Remove any pieces of ice from the water.** Check to be sure that the water is within the correct temperature range and that the thermometer has stopped changing. Read the temperature of the water in Beaker 1 to the nearest whole degree and record it on Data Table A. Remove the thermometer from the beaker.

3. **Read This Entire Step Before Continuing**. Drop an antacid tablet into Beaker 1. Start the stopwatch timing at the instant the tablet enters the water. Stop timing when the last piece of the tablet dissolves. (You do not have to wait for all the bubbling to stop; wait only for all the pieces of the tablet to disappear.) Read the time in seconds. Record the time to the nearest whole second on Data Table A.

4. Repeat steps 2 and 3 for each of the remaining beakers.

5. Plot a line graph of the data for the 5 trials. One graph axis will be temperature (in degrees C) and the other will be the time (in seconds.) Connect the 5 plot points with a smooth curve or a point to point straight line. Label each point with the beaker number.

DATA TABLE A: TEMPERATURE VS. RATE

Beaker Number	Temperature	Time (seconds)
1		
2		
3		
4		
5		

PART B: SURFACE AREA VS. RATE

6. Obtain 3 more antacid tablets from your teacher. Break one of the tablets into 4 equal size pieces and crush another in a paper towel.

7. Setup 3 new beakers with 200 ml of water in each with a water temperature between 20-25 C. Try to get all 3 water temperatures as close to the same temperature as possible.

8. Drop the whole tablet into beaker 1 and record the time in seconds that it takes to dissolve.

9. Repeat this same procedure with the quartered tablet and the crushed tablet.

10. Plot a graph of the data for these three trials. Plot a line graph of tablet size vs. time (in seconds).

DATA TABLE B: SURFACE AREA VS. RATE

Beaker Number	Temperature	Time (seconds)
1- Whole Tablet	20-25°C	
2- Quartered Tablet	20-25°C	
3- Crushed Tablet	20-25°C	

LABORATORY QUESTIONS

1. In which beaker did the reaction occur the most slowly?

   _____

   The most rapidly?

   _____

2. What is the relationship between the temperature and the rate of reaction?

   _____

   _____

3. Based upon your observations, what do you think is the relationship between the temperature and the rate of natural chemical weathering?

   _____

   _____

4. Turn to the map of Earth's Climate on page 664 of your textbook. Locate Rio de Janeiro in South America and Seattle in North America. Compare the weathering rate of limestone in Rio de Janeiro with that of a limestone in Seattle.

   _____

   _____

5. Now locate Barrow, Alaska on the same map. Explain why a limestone in Barrow is likely to weather more slowly?

   _____

6. What effect does the particle size of the tablet have on the rate of reaction?

   _____

7. According to your graph in Part A, how long would it take a tablet to dissolve if the temperature of the water was 28 degrees C.?

   _____

8. For Part B how would your data for time be different if the temperature of the water was hotter?

   _____