

# Philosopher's Stone

You work for Philosopher's Stone, Inc., a company that specializes in the development of crystal production processes. Your company subcontracts with major product companies to develop methods for crystallizing their products. Your company has developed processes for crystallizing many different kinds of products, including soap, sugar substitute, computer chips, fertilizer, and quartz timers for watches.

You work in the Basic Research group. The function of your group is to test the effects of environmental conditions on the growth rate of crystals. You, and the other members of your team, have been assigned to a new project. ACME Powders has contracted your company to develop the crystallization process for a new product line they are developing. They will not divulge the nature of the substance due to proprietary concerns on their part. But they have assured your company that it is nonhazardous. They need preliminary findings in two months. Given that it takes two weeks for test results to go through peer review, two weeks to go through editing, and another two weeks to get final approval of the executive staff, this gives you two weeks to develop your tests, perform the tests, and publish the results.

Due to the sensitive nature of crystal growing and the accelerated schedule of testing, your group cannot afford to make mistakes with the tests. Your manager has decided to divide the test variables among the staff, one variable to a person. Each person will work individually to test the effects of the assigned variable on crystal growth rate and final crystal size. More than one person will be independently testing each variable, so if something goes wrong with your test, it will not ruin the experiment.

## OBJECTIVES

**Design** an experiment to test the effects on crystal growth rate and size of your assigned variable.

**Compute** crystal growth rates.

**Differentiate** between the effects of environmental variables on crystal growth.

## MATERIALS

- Bowl, wide and shallow (2)
- Flashlight
- Food coloring (stock)
- Magnifying glass or microscope
- Metric ruler with clearly marked mm divisions
- Notebook
- Objects, metal, small miscellaneous (stock)
- Rocks, small clean (stock)
- Pencil, graphite
- Test solution (stock)



## Philosopher's Stone *continued*

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### Procedure

1. Within your lab team, assign one or more lab team members to test one of the following variables:

Variable: salt solution concentration

Team member: \_\_\_\_\_

Variable: temperature

Team member: \_\_\_\_\_

Variable: addition of food coloring

Team member: \_\_\_\_\_

Variable: metal objects instead of rocks

Team member: \_\_\_\_\_

2. For the variable assigned to you, develop a question statement associated with the subject of your study and record it below.

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3. Form a hypothesis as to the answer to the question written above.

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4. Design a controlled experiment by modeling the growth of crystals in the laboratory and developing a procedure to gather data to test your hypothesis. Draw the layout of your lab setup, and write your procedure on a separate sheet of paper.

5. Over the next two weeks, perform your experiment. Use a notebook and pencil to record your observations and data. Establish regular intervals to observe crystal growth. Once you have completed your experiment, the following questions below will help you analyze the data and draw conclusions on the effects of the variable on crystal growth.

### Analysis

1. **Describing Events** Describe how your crystals grew. Establish regular intervals to observe crystal growth. Could you see the growth as it happened, or was it apparent only by daily observation? Did the crystals grow symmetrically or in clumps? Identify other phenomena of growth.

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## Philosopher's Stone *continued*

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- 2. Explaining Events** Explain the standard of measuring crystal growth and calculating growth rate that you and your team established at the beginning of testing.

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- 3. Organizing Data** Calculate the growth rate based upon your measurements. How you calculate growth rate was determined in the standards discussion your team had at the beginning of testing. Record these growth rate values for each day in Table 1.

- 4. Constructing Graphs** On a sheet of graph paper, draw a line graph of the growth rate values calculated in Question 3 over time.

## Conclusions

- 5. Analyzing Graphs** Compare your graphs with the graphs of others on your lab team who tested the other variables. What variable seems to have the greatest effect on crystal growth rate?

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- 6. Drawing Conclusions** Draw a conclusion as to whether your hypothesis was correct. Record your conclusion in the space below.

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**Philosopher's Stone** *continued***DAILY CRYSTAL GROWTH RATE**

	<b>Growth Rates</b>	
<b>Day</b>	<b>Test Case:</b>	<b>Control Case:</b>
1	not measured	not measured
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

**Extension**

- 1. Research and Communication** Prepare a one-page summary report to your manager of the results of your experiment. In your report, discuss other factors that your team did not test or that were out of your control that may have influenced the results of your testing.