

## Whistling at the Aurora

### Overview:

Students use the scientific method to determine whether there are connections between whistling and aurora activity.

### Objectives:

The student will:

- hypothesize the relationship between whistling and aurora activity;
- conduct an experiment;
- compile data on aurora activity observations;
- analyze data on aurora activity collected by student and class; and
- identify the relationship between whistling and the aurora and explain this conclusion.

### Materials:

- Stopwatch
- Musical whistle or a person who can whistle
- STUDENT WORKSHEET: “Whistling at the Aurora”

**Teacher’s Note:** *This activity takes more than one day, and it requires students to stay up between 10 p.m. and 2 a.m. when the aurora is frequently visible. For scientific predictions of when the aurora will be visible from your location, visit the Geophysical Institute website: (<http://www.gi.alaska.edu/>). Click on **Aurora Forecast**.*



### Activity Procedure:

1. Explain there are many aurora legends that describe the aurora responding to noises made by people on Earth. For instance, Inupiat Elders in Noatak, Alaska whistle and holler at the aurora, which they say sometimes makes it swoop down to Earth. In Canada, Native Elders whisper at the aurora, or spit at it to make the colors run together or suddenly change form. Explain that this experiment investigates if there is a connection between whistling and aurora activity.
2. Distribute materials to each student and assign a specific evening or time during the evening for each student to perform the experiment. Each student will need three 20-minute time segments. It is important that each student does the experiment at a different time, so that one student is not quietly observing the aurora while another is whistling.
3. Review the experiment procedure, and practice operating the stopwatch. Allow students the necessary number of days to complete their experiments.
4. After all students have completed their experiments, compile data and analyze as a class. Discuss the following questions: a) Does the class-wide data support the same conclusion as individual data? Why or why not? b) Discuss sample size; c) What were the variables in this experiment? d) What were the controls? e) How might the variables have affected the outcome? f) What further questions do students have after completing the experiment?

### Answers to Student Worksheet:

*Answers within lab packets will vary, however, data should support the conclusion, and the conclusion should identify whether the hypothesis was supported or unsupported.*

## Whistling at the Aurora

### **Testable Question:**

Does aurora activity increase when a person whistles at the aurora?

### **Background Information:**

Many legends describe the aurora responding to noises made by people on Earth. For instance, Inupiat Elders in Noatak, Alaska whistle and holler at the aurora, which they say sometimes makes it swoop down to Earth. In Canada, Native Elders whisper at the aurora, or spit at it to make the colors run together or suddenly change form. Since the aurora is approximately 100 kilometers (100,000 meters) above Earth, and the approximate speed of sound through air is 330 meters per second, sound takes approximately 303 seconds (about 5 minutes) to reach the aurora from Earth, if the aurora is directly overhead.

$$\begin{aligned} \text{Distance from Earth to aurora} \div \text{speed of sound} &= \text{time for sound from Earth to reach aurora} \\ 100,000 \text{ meters} \div 330 \text{ meters per second} &= 303 \text{ seconds} \\ 303 \text{ seconds} \div 60 \text{ seconds per minute} &= \text{approximately 5 minutes} \end{aligned}$$

If the aurora is on the horizon, rather than directly overhead, it is about twice as far away. Therefore, sound will take twice as long (10 minutes) to reach it.

### **Hypothesis:**

Use the background information provided by your teacher or on this worksheet to make a hypothesis (Check one):

- \_\_\_\_\_ Aurora activity will increase when a person whistles at the aurora.  
\_\_\_\_\_ Aurora activity will decrease when a person whistles at the aurora.  
\_\_\_\_\_ Whistling will not affect aurora activity.

### **Experiment:**

#### **Materials:**

- Musical whistle or a person who can whistle
- Stopwatch

#### **Procedure:**

1. Go outside with materials and observe the aurora on the evenings and times assigned by your teacher.
2. Start the stopwatch and observe the aurora quietly for 10 minutes, recording aurora activity levels in the "Before Whistle" column of the Aurora Activity Data Table, each minute. Circle "2" if the aurora danced constantly throughout the minute; "1" if the aurora danced only part of the time, or if only part of the curtain danced throughout the minute; and "0" if it remained still throughout the minute.
3. Reset the stopwatch, then start it again and whistle at the aurora for 30 seconds.
4. Observe the aurora for 10 minutes, recording activity levels in the "After Whistle" column of the Aurora Activity Data Table during each minute.
5. Repeat steps 2-4, using a new Aurora Activity Data Table for each sample.

Name: \_\_\_\_\_

# Whistling at the Aurora

**Data:**

Sample #1: Date: \_\_\_\_\_ Time: \_\_\_\_\_ AM / PM

Location: \_\_\_\_\_

Aurora Activity Data Table #1

**Before Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level	0	0	0	0	0	0	0	0	0	0
(circle one)	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

**After Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level	0	0	0	0	0	0	0	0	0	0
(circle one)	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

Sample #2: Date: \_\_\_\_\_ Time: \_\_\_\_\_ AM / PM

Location: \_\_\_\_\_

Aurora Activity Data Table #2

**Before Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level	0	0	0	0	0	0	0	0	0	0
(circle one)	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

**After Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level	0	0	0	0	0	0	0	0	0	0
(circle one)	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

Name: \_\_\_\_\_

# Whistling at the Aurora

Sample #3: Date: \_\_\_\_\_ Time: \_\_\_\_\_ AM / PM

Location: \_\_\_\_\_

Aurora Activity Data Table #3

**Before Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level (circle one)	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

**After Whistle**

Minute	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Activity Level (circle one)	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2

**Analysis of Data:**

1. Average the “Before Whistle” activity levels for each sample by adding together the circled Activity Level values and dividing by 10 (see formulas below).

Sample #1 Before Whistle Average:

$$\left( \underset{1st}{\quad} + \underset{2nd}{\quad} + \underset{3rd}{\quad} + \underset{4th}{\quad} + \underset{5th}{\quad} + \underset{6th}{\quad} + \underset{7th}{\quad} + \underset{8th}{\quad} + \underset{9th}{\quad} + \underset{10th}{\quad} \right) \div 10 = \text{Sample 1 Average}$$

Sample #2 Before Whistle Average:

$$\left( \underset{1st}{\quad} + \underset{2nd}{\quad} + \underset{3rd}{\quad} + \underset{4th}{\quad} + \underset{5th}{\quad} + \underset{6th}{\quad} + \underset{7th}{\quad} + \underset{8th}{\quad} + \underset{9th}{\quad} + \underset{10th}{\quad} \right) \div 10 = \text{Sample 2 Average}$$

Sample #3 Before Whistle Average:

$$\left( \underset{1st}{\quad} + \underset{2nd}{\quad} + \underset{3rd}{\quad} + \underset{4th}{\quad} + \underset{5th}{\quad} + \underset{6th}{\quad} + \underset{7th}{\quad} + \underset{8th}{\quad} + \underset{9th}{\quad} + \underset{10th}{\quad} \right) \div 10 = \text{Sample 3 Average}$$

Overall Before Whistle Average:

$$\left( \text{Sample 1 Average} + \text{Sample 2 Average} + \text{Sample 3 Average} \right) \div 3 = \text{Before Whistle Average}$$

# Whistling at the Aurora

2. Average the After Whistle activity levels for each sample by adding together the circled Activity Level values and dividing by 10 (see formulas below).

Sample #1 After Whistle Average:

$$\left( \begin{array}{cccccccccc} \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \\ \text{1st} & \text{2nd} & \text{3rd} & \text{4th} & \text{5th} & \text{6th} & \text{7th} & \text{8th} & \text{9th} & \text{10th} \end{array} \right) \div 10 = \text{Sample 1 Average}$$

Sample #2 After Whistle Average:

$$\left( \begin{array}{cccccccccc} \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \\ \text{1st} & \text{2nd} & \text{3rd} & \text{4th} & \text{5th} & \text{6th} & \text{7th} & \text{8th} & \text{9th} & \text{10th} \end{array} \right) \div 10 = \text{Sample 2 Average}$$

Sample #3 After Whistle Average:

$$\left( \begin{array}{cccccccccc} \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } & \text{ } \\ \text{1st} & \text{2nd} & \text{3rd} & \text{4th} & \text{5th} & \text{6th} & \text{7th} & \text{8th} & \text{9th} & \text{10th} \end{array} \right) \div 10 = \text{Sample 3 Average}$$

Overall After Whistle Average:

$$\left( \begin{array}{cccc} \text{ } & \text{ } & \text{ } & \text{ } \\ \text{Sample 1 Average} & \text{Sample 2 Average} & \text{Sample 3 Average} & \text{Before Whistle Average} \end{array} \right) \div 3 = \text{ }$$

3. Compare the “Overall Before Whistle Average” to the “Overall After Whistle Average.” Did aurora activity increase when a person whistled at the aurora?

\_\_\_\_\_

4. Sound on Earth’s surface takes 5 to 10 minutes to reach the aurora. Did you notice a sudden increase in aurora activity between minutes 5 and 10 of your After Whistle samples?

\_\_\_\_\_

**Conclusion:**

Make a check mark next to your conclusion.

- Aurora activity will increase when a person whistles at the aurora.
- Aurora activity will decrease when a person whistles at the aurora.
- Whistling will not affect aurora activity.

Was your hypothesis proved or disproved? \_\_\_\_\_

Explain what evidence supports your conclusion. Use complete sentences.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_