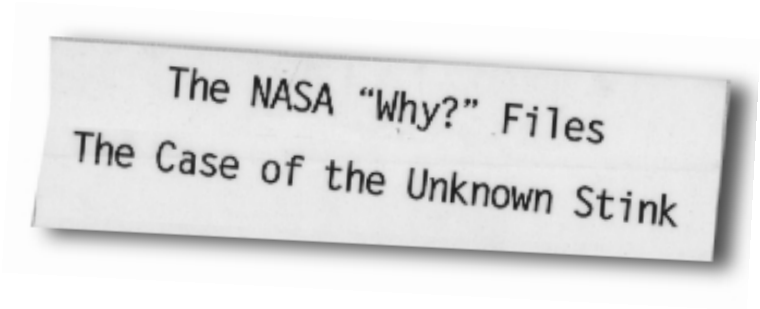
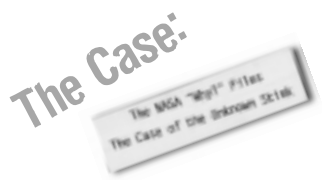
Part 4



Part 4 | This is it!



Age Range
Ages 8-10

Duration
15 Minutes

Science Concepts
Unifying Concepts and Processes
Science as Inquiry
Earth and Space Science
Science and Technology
History and Nature of Science

Mathematics Concepts
Numbers and Operations
Patterns, Functions, and Algebra
Measurement
Data Analysis, Statistics, and Probability
Connections

Key Science Vocabulary
matrix
meteorologist
atmosphere
anemometer
clockwise
counterclockwise
satellite
kilometer
molecule
butyric acid*
ethyl alcohol*
sulfuric acid*

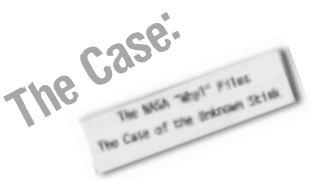
Program Overview

Part 4 : This is it!

The three "smell detectives" are getting very close to solving the problem of the mysterious smell. They determine that wind is definitely a factor, and they visit a weatherman (meteorologist) to find out more about the wind and the wind direction on each of the days when the towns noticed the bad odor. Dr. D suggests that they create a matrix to organize their data. The video children visit a NASA atmospheric science researcher to learn if wind can move smells long distances. The researcher describes some NASA atmospheric experiments proving that smelly gases can travel between continents and oceans. The tree house detectives, however, are still confused. The evidence points to some source near Exville, but the map does not indicate a facility there which could be a possible cause of the bad odor. Dr. D and the children visit Exville. Much to their surprise, the stink's source seems to be the new candy factory. After returning to his lab, Dr. D performs an experiment to demonstrate that unpleasant-smelling chemicals can produce sweet-tasting substances. The mystery is solved; the candy factory is the cause of the stink! Television station KSNN features the children telling how they used methods of science to find the solution to the problem.

To close the program series, Dr. D makes some summary comments about procedures for studying science and safety measures when doing experiments.

** Wait until after the students have viewed Program 4 to discuss the remaining key science vocabulary because the words and their meanings will "give away" the solution to the problem of the unpleasant odor source.*



Science Concepts

Part 4 : This is it!

National Science Teachers Association (NSTA) Standards

Unifying Concepts and Processes

Students develop an understanding that evidence consists of observations and data on which to base scientific explanations.

- Use observations, measure ment tools, and experiments to gather information for basing explanations about investigations.

Science as Inquiry

Students develop abilities necessary to do/to understand scientific inquiry.

- Observe and ask questions to identify problems.
- Employ simple equipment and tools to gather data.
- Use the data to construct a reasonable explanation.

Earth and Space Science

Students understand certain concepts about weather and how weather can be described by measurable quantities.

- Observe changes and patterns in wind direction.
- Learn about instruments used in gathering weather data.

Science and Technology

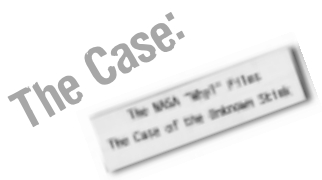
Students develop abilities to understand how technological systems work to help solve problems.

- Use technological designs/ tools to gather information.

History and Nature of Science

Students understand that science is a human endeavor.

- Recognize that people of all backgrounds engage in various science career activities.



Mathematics Concepts

Part 4 : This is it!

National Council of Teachers of Mathematics (NCTM) Standards

Numbers and Operations

Students understand numbers and operations.

- Use computational tools and strategies fluently and estimate appropriately.

Patterns, Functions, and Algebra

Students understand and use various types of patterns, functions, symbols, and models.

- Represent and record patterns using tools such as tables and graphs.
- Understand the concept of variables and use variables to solve problems.

Measurement

Students understand attributes, units, and systems of measurement.

- Use appropriate techniques and tools for determining measurement.

Data Analysis, Statistics, and Probability

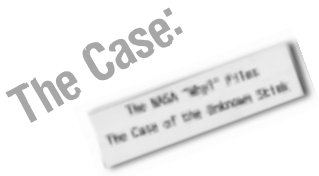
Students pose questions and collect, organize, and interpret data to answer those questions.

- Organize data by using tables and graphs.
- Use graphs and tables to analyze data and present information to an audience.

Connections

Students recognize, use, and learn about mathematics in contexts outside of mathematics.

- Observe the mathematics and science connections in problem solving and experiments.



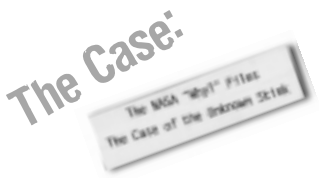
Key Science Vocabulary

Part 4 : This is it!

matrix	a rectangular arrangement of elements in rows and columns
meteorologist	a scientist that deals with the science of the atmosphere, especially with weather and weather forecasting
atmosphere	the mass of air surrounding the Earth
anemometer	an instrument for measuring wind force and velocity (speed)
clockwise	in the same direction as the rotating hands of a clock
counterclockwise	in a direction opposite to the rotating hands of a clock
satellite	a celestial body orbiting another of larger size; a secondary planet; or a man-made object or vehicle intended to orbit the Earth, the Moon, or another celestial body and usually instrumented for the transmission of space data
kilometer	a metric unit of length (1.61 kilometers = 1 mile)
molecule	a unit of matter that is the smallest particle into which an element or compound can be divided without changing its chemical and physical properties

* ***Wait until after the students have viewed Program 4*** *to discuss the remaining key science vocabulary, because the words and their meanings will "give away" the solution to the problem of the unpleasant odor source.*

butyric acid*	an acid found especially in butter in the form of glycerides; in rancid butter, the free acid obtained as a colorless liquid of unpleasant odor; used chiefly in making esters (flavoring materials) or in cellulose for plastics
ethyl alcohol*	ordinary alcohol, often referred to as "household" or "rubbing" alcohol
sulfuric acid*	an acid produced from sulfur oxide; a highly corrosive, dense, oily liquid used to manufacture a wide variety of chemicals and materials



Before Viewing
(Questions 1-3)

After Viewing
(Questions 4-18)

Program Discussion

Part 4 : This is it!

Before Viewing

1) Have the students explain why safety measures are important in conducting all experiments. Ask the students to suggest some safety precautions for performing experiments. Have them tell how the children protected their classmates' eyes and noses during the classroom smell experiments.

The students should discuss why the safety of the experimenters must always be considered in planning and conducting experiments. Safety measures should include protecting all body parts from possible injury when using objects, tools, and substances. Encourage the students to suggest some general precautions such as wearing goggles, gloves, lab aprons, or coats; reading the labels on all substances to be used; keeping a water supply close by; and working under the supervision of an adult.

The children in the video used an "everyday" room spray that did not contain dangerous substances. The spray was never pointed directly at the participants. The sniffers kept their eyes closed, and none of the participants stood close to the sprayer. Although the action was not shown in the video, the teacher had checked to make sure that any students with allergies or respiratory problems were excluded from the experiment.

2) Ask the students to explain the pattern that the children in the video kept noticing when they analyzed the results of the classroom smell experiments. Have them tell how the pattern might be related to the reports from the towns smelling the unpleasant odor.

It always took longer for the students standing behind and beside the fan to smell the spray than for those standing in front of the fan.

If the wind was moving the bad smell, those towns directly in front of the wind's direction on a particular day would smell the odor faster and stronger than those towns located behind or beside the direction of the wind.

3) Have the students think back to Program 3 and predict what experts the children in the video will visit next.

The children in the video will visit a weatherman (meteorologist) and a NASA atmospheric science researcher.

After Viewing

4) Let the students react to the solution of the problem and the predictions they made on the post-it notes activity for Program 3.

The students will have various comments about how the candy factory was the cause of the bad odor and why they had predicted one of the other places or "unknown" as the source of the stink. They may want to share their favorite parts of the program series, their favorite characters, humorous incidents, what they learned, and so forth.

5) Ask the students to explain why/how the candy factory was the cause of the stink.

The chemicals used in making the candy had unpleasant odors until they were mixed and processed to produce the candy. The bad smells of the chemicals were escaping or being emitted into the air before they were processed. Now that they are alerted to the situation, the factory owners and managers promise to take steps to eliminate this problem (*See "Yummies for the Tummies" page 72.)*

6) Have the students explain why the children in the video had not considered the candy factory in any of their hypotheses.

The candy factory was so new that it was not on the map the children in the video were using. Also, the children might not have suspected the candy factory because they may have thought that something as pleasant-tasting as candy would not be made from something that smelled so unpleasant.

7) Ask the students how the information provided by the weatherman was useful to the three investigators in solving the stink problem.

The weatherman confirmed that the wind does affect the movement of smells. He gave the children weather maps which showed the direction of the wind on each of the days that the towns' residents had been smelling the unpleasant odor. By using the wind direction data, the E-mail information, and the area map, the children were able to get an idea of where the stink was originating (*See "Which way does the wind blow?" page 73.)*

8) Have the students explain what a weatherperson (meteorologist) does and some of the weather prediction tools that the meteorologist in the video showed the tree house detectives.

A meteorologist studies the atmosphere, especially weather. He/she knows how to use data such as temperature, air pressure, and wind direction to help predict weather conditions.

The meteorologist in the video showed the children an anemometer, a wind vane, weather maps, and a computer (*See "Weather Instruments" page 74.)*

9) Ask the students why it is important to know about the day's weather and the prediction of the weather for several days.

Accept all responses for which the students can give logical explanations. They will probably suggest things such as knowing the most appropriate clothes to wear, what outdoor activities to plan, whether it would be a good

After Viewing (Continued)

time to travel, whether to leave pets outside for the day, how to prepare for any special weather conditions (e.g., ice or snowstorm, hurricane, and so forth).

10) Ask the students how they might prove that the wind changes directions.

Accept all responses for which the students can give logical explanations. They will probably suggest listening to radio or television weather reports, reading newspaper weather reports, observing wind socks on their home decks, or watching weather vanes on their roofs and then recording or charting the wind directions for several days.

11) Have the students describe and sketch on the chalkboard the matrix that Dr. D suggested the children in the video design to organize the information they had collected.

The matrix was a chart with columns in which the days of the week were written across the top and the names of the towns were listed along the left side. "**X**" symbols were used to designate the wind direction for each location on each day of the week.

12) Ask the students to summarize some of the information provided to the children in the video by the NASA atmospheric science researcher.

Tracking gases in the atmosphere is part of NASA's atmospheric science research. The researchers use special equipment and instruments on planes and satellites. One experiment involved tracking smoke molecules from fires in South America and Africa for hundreds of kilometers or miles. The pollution traveled over much of the world. The pollution molecules will eventually react with other gases in the atmosphere to become other molecules that will be dissolved in rainwater and released from the atmosphere when it rains.

13) Assist the students with bringing their Need to Know Board up-to-date. Ask them what they observe about the chart now. (Only the additions are shown.)

Need to Know Board

What we know	What we need to know	Where to go for help
Wind moves smell		Weather person (Meteorologist)
Who smelled the odor on each day?		NASA atmospheric science researcher
What generates wind?		
Wind can change direction		
Wind direction for each day		

The students should observe that the "need to know" items have become "what we know" items.

14) Have the students summarize the steps of the scientific method that the tree house investigators used to discover what caused the stink.

After Viewing (Continued)

The children in the video identified the problem (What is the source or cause of the stink?) and asked questions about the problem. They determined what they already knew, what they needed to know, and where to go for additional information or help. They formed several different hypotheses; collected, organized, and analyzed their data; experimented; and changed their hypotheses when the data did not support their predictions. The children used observation, books, the Internet, E-mail, and experts to gather their information. They eventually solved the problem by analyzing all of their data and finding the hypothesis that was supported by the data (The candy factory is the source of the odor.)

15) List the responses on the chalkboard when you ask the students to name the various technology used in the program series to provide the information which helped solve the problem. (The important instructional concept is for the students to understand that the term technology refers to methods, materials, and tools used in the application of science. They are not expected to name all the specific technologies in the series.)

The students will probably name things such as these: computer, internet, E-mail, television, books, experts, map, telephone, waste water treatment plant equipment (meter, aeration basin, scrubber), receptor, stopwatch, fan, aquarium or shark tank, bar graph, matrix, anemometer, wind vane, weather map, satellite, airplane, and chemicals.

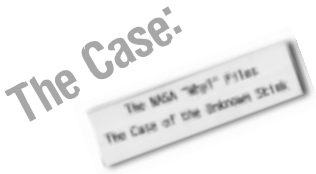
16) Explain to the students that the term "variable" can be used in mathematics as well as science.

Discuss how the terms are used to mean different things; for example, “variable” in science means something that can be controlled by the experimenter, while “variable” in mathematics can be a letter or symbol used to stand for an unknown number in equations.

If your mathematics curriculum includes equations with variables, teach or review a lesson on equations with variables and provide practice for the students in solving the equations.

17) Have the students identify a problem that the class can try to solve by using the scientific method. Work with them to seek the solution to the problem. Remind them that the scientific method can be used for any problem they may encounter in everyday life.

18) Consider introducing a weather unit at this time or correlating an ongoing weather unit with the video program.



NOTE:
The extensions can be class or individual enrichment activities and should be selected and/or adapted according to student developmental levels.

Program Extensions

Part 4 : This is it!

1. Science, Technology, and Mathematics
Ask the students to watch one of their local radio or television news programs or use a daily newspaper to chart the weather conditions for a week or longer. Suggest that they record the wind direction; the high and low temperatures; and whether there was sunshine, cloudiness, and/or precipitation. Some students may wish to make this a monthly project.

2. Science, Technology, and Language Arts
Have interested students use the Internet or available print materials for directions to construct a wind vane or gauge and demonstrate it to the class. Suggest that they use their vane/gauge to determine and chart the wind direction for a given period. Let them share their findings with the class orally and by displaying their vane/gauge and chart.

3. Science, Technology, and Language Arts
Ask interested students to use the Internet or available print materials to learn more about meteorology as a career. Have them write a paper telling about the job tasks, training requirements, and special skills needed to be a meteorologist. Have them include why they would or would not like to be a meteorologist.

4. Science and Language Arts
Have the students select an occupation (other than meteorologist) that they feel is dependent on the weather and write a paragraph explaining why they believe the occupation is affected by the weather. They may include an occupation such as a construction worker, bus driver, pilot, landscaper, farmer, or professional skier.

5. Science and Mathematics
Have the students suggest data that could be recorded on a matrix and have them design a matrix of their own and record data of their choice. For example, they might chart (1) their test grades for a week, (2) the height and/or weight of their friends, or (3) the number of points scored by their favorite professional basketball player in a certain number of games.

6. Science and Language Arts
Discuss with the students whether they think it is important to study and track world pollution and tell why or why not.

7. Science, Technology, Language Arts, and Art
Have the students use the Internet or other available print materials to write a paper about the particular kind of pollution that most concerns them; why they are concerned; and what, if anything, is being done to improve the pollution problem. Suggest that they draw a poster asking people to help reduce or eliminate that particular kind of pollution.

8. Mathematics and Geography
Have the students locate the continents of South America and Africa on a globe or map. Ask the students to use the map scale, if one is available, to estimate the distance from South America to their location in the United States and from Africa to their location in the United States.

Have the students convert the estimated distances from miles to kilometers (miles x 1.61). For additional practice, give the students some other distances (in statute miles) to convert to kilometers and/or from kilometers to miles (kilometers x 0.62).

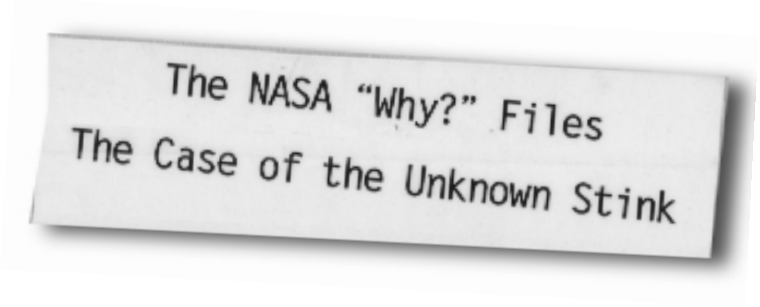
9. Mathematics and Language Arts
Have small groups of students work together as researchers to conduct a survey among their friends, neighbors, or family to find the farthest distance that the people surveyed have traveled from home to another destination on a one-way trip. Direct the students to chart or graph their results and report the findings to the class orally.

10. Science, Mathematics, and Language Arts
Remind the students that they "met" a number of experts in the program series (science professor, NASA electronics engineer, NASA atmospheric science researcher, otolaryngologist, meteorologist, waste water treatment plant scientist, and museum curator). Ask the students to select one of the experts and write a paper telling why that particular expert needed science and mathematics courses in school when he/she was preparing for his/her career. Include how the expert uses both science and mathematics in performing his/her job.

11. Science and Language Arts
Let the students choose their favorite character in the program series and write a paragraph telling why they picked the particular character and how that character contributed to solving the stink problem.

12. Science and Technology
Encourage the use of the NASA "Why?" Files web site.
http://whyfiles.larc.nasa.gov

Exercises



Part 4 : This is it!

Yummies for Tummies

Review

In the video, the Tree House Detectives discovered it was the candy factory that was creating the stink. However, not all candy making has to smell bad. Here is a quick recipe for you to follow to make your own sweet smelling candy.

The Recipe

Peanut Butter Balls
For students who are allergic to peanuts, you can leave out the peanut butter and add a teaspoon of vanilla.

Ingredients

- 1 box of 10x confectioner's sugar
- 1 stick butter or margarine
- 3/4 cup peanut butter
- 10 plain chocolate bars
- toothpicks
- waxed paper

Steps

1) Allow butter or margarine to soften.
2) Add sugar and thoroughly combine.
3) Last, add the peanut butter (or vanilla) and knead the mixture until smooth.
4) Pinch off small amounts and roll into 1 inch balls.

Adult Must Do Steps 5 –7

5) Melt chocolate in a double boiler or in microwave.
6) Students will now insert a toothpick into their peanut butter ball and dip into the melted chocolate if desired.
7) Place on waxed paper until cooled and the chocolate has hardened.

Eat and Enjoy!

8) Be sure you smell the chocolate and peanut butter to better enjoy the taste.

Which way does the wind blow?

Using a wind vane and compass, go outside and make recordings of the direction of the wind at the same time each day for the AM and repeat for the PM. Record your observations in the chart and compare. Determine if there is a pattern in wind direction.

Date	Time AM	Wind Direction	Time PM	Wind Direction

Conclusion

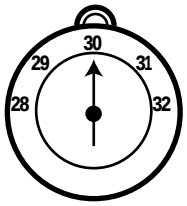
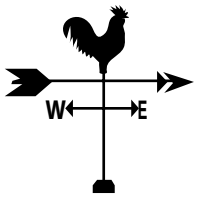
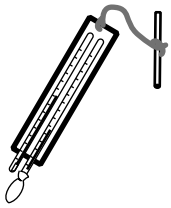
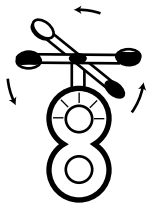
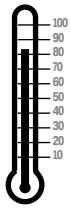
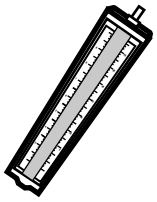
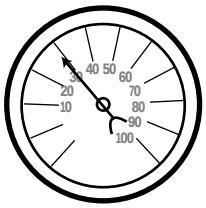
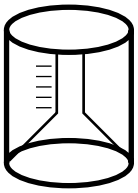
1. Did the wind blow from the same direction each day?

2. Did the wind always blow from the same directions in the AM? PM?

3. Explain your answers and why you think it is so.

Weather Instruments

Match each weather instrument to its definition.

A  **Barometer**	**B**  **Wind Vane**	**C**  **Psychrometer**	**D**  **Anemometer**
E  **Thermometer**	**F**  **Wind Meter**	**G**  **Hygrometer**	**H**  **Rain Gauge**

_____ 1. Measures wind speed.

_____ 2. Tells from which direction the wind is blowing.

_____ 3. Measures wind speed.

_____ 4. Measures air pressure.

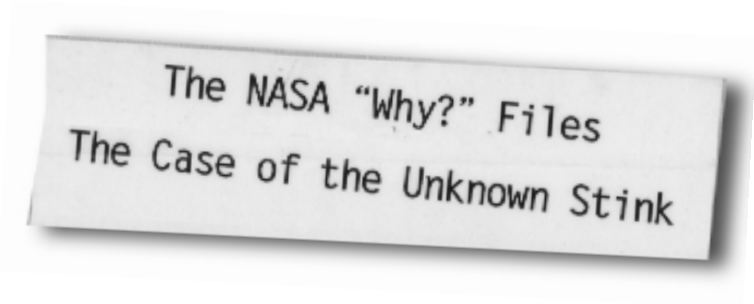
_____ 5. Measures air temperature.

_____ 6. Measures humidity.

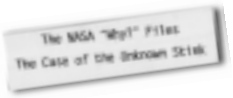
_____ 7. Measures humidity.

_____ 8. Measures the amount of precipitation.

Related Literature



Related Children's Literature



Kramer, Stephen P.:
How to Think Like a Scientist: Answering Questions by the Scientific Method.
Thomas Y. Crowell, (1997). ISBN 0690045654

Carey, Stephen S.: *A Beginner's Guide to Scientific Method.* International Thomson Publishing, (1997). ISBN 0534528430

Kneidel, Sally S.: *Creepy Crawlies and the Scientific Method: More Than 100 Hands-On Science Experiments for Children.* Fulcrum Publishing, (1993). ISBN 155511188

Sprung, Barbara and Patricia B. Campbell, and Merle Froschi: *What Will Happen If...-Young Children and the Scientific Method.* Educational Equity Concepts Incorporated, (1985). ISBN 0931629020

Parker, Steve: *Shocking, Slimy, Stinky, Shiny Science Experiments.* Sterling Publishing Company Inc., New York, (1998). ISBN 080696295X

Markle, Sandra: *Measuring Up!: Experiments, Puzzles, and Games Exploring Measurement.* Atheneum, (1995) ISBN 0689319045

Levine, Shar and Leslie Johnstone: *The Microscope Book.* Sterling Publishing Company, New York, (1996). ISBN 0806948981

Hickman, Pamela: *Animal Senses: How Animals See, Hear, Taste, Smell and Feel.*
Kids Can Press, (1998). ISBN 1550744232

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