

S.T.E.M. Fair Lesson Plan Day 1
Posing Questions

	<p>Objective: The student will be given several topics about the natural world in order to develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations.</p> <p>Materials: 2 hard-boiled eggs, 2 beakers, sugar, <u>Nature of Science and Technology</u> p. 13, <u>Inquiry Skills Activity Book</u> I for grade 6, II for grade 7, III for grade 8,</p> <p>Technology: overhead</p> <p>Vocabulary: scientific inquiry, question, observation</p> <p>Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.A.1.b</p>
ENGAGEMENT	<p>Building Background Knowledge Ask: What are some problems you have solved recently, such as having to fix something or having to decide how to proceed in treating an injury or illness? (<i>Students might describe fixing a broken bicycle or overcoming a sports injury.</i>) Then ask: What were the steps you used in solving this problem? (<i>Students might answer that they first tried to figure out exactly what was wrong and then they tried to decide how to proceed and fix the problem.</i>) Say: When a problem is observed, we wonder or question why a particular situation occurs. When we are really interested, we begin to research background information about the situation. Then, we begin to find ways to 'fix' a problem.</p>	
EXPLORATION	<p>DA p. 13 What's Happening? (Nature of Science and Technology) Skills focus: Posing a question Materials: 2 hard-boiled eggs, 2 beakers, sugar Time: 10 minutes Tips: For each group, fill two beakers with 500mL of water. Add sugar to one beaker so that an egg will float -170g (3/4 cup) sugar works well. Water may need to be heated to dissolve sugar; let cool. Expected Outcome: Students will observe that the egg placed in one beaker will sink and the egg placed in the other beaker (with sugar water) will float. Students are to write down 3 questions they have about their observations. Next, students need to list how they could find out the answer.</p>	
EXPLANATION	<p>Teaching Key Concepts: <u>Inquiry Skills Activity Book I, II, or III</u> p. 39 Explain to students that a scientist often begins the process of inquiry by posing questions about an observation. Have students think about an iPod, CD player, or cell phone that has stopped working. Then elicit responses about questions (i.e. Are the batteries working? Did I drop it? Is it old?) they might ask themselves based on the observation that the item does not work. Record their questions on the board or overhead. Have the students assess how each question might lead to scientific inquiry or questioning that may involve gathering evidence. Read p. 39 of <u>Inquiry Skills Activity Book I</u> for 6th grade, <u>II</u> for 7th grade, or <u>III</u> for 8th grade.</p>	
ELABORATION	<p>Skills Practice: <u>Inquiry Skills Activity Book I, II, or III</u> p. 40 Have students complete the Skills Practice on turning observations into questions. After completion of skills practice, have students write down topics that may interest them for science fair. They are to take those topics and turn them into possible questions they will investigate for science fair.</p>	
EVALUATION	<p>Skills Practice p. 40 of <u>Inquiry Skills Activity Book</u> Homework: Develop a research question for investigation. Complete a small paragraph including background information on the selected topic. Support information using informational text, internet resources and/or expert witnesses. Note: Students need more than one night to select a final science fair topic. Students may also need library time in order to assist with a topic selection.</p>	

S.T.E.M. Fair Lesson Plan Day 2

Hypothesis

	<p>Objective: The students will pose a question after observing the movement of water molecules in order to write a testable hypothesis.</p> <p>Materials: 100 mL of hot water, 100 mL of cold water, dark food coloring, 2 clear cups, timer or stopwatch (per group); <u>Inquiry Skills Activity Books I, II, III</u>; <u>Nature of Science and Technology</u> p.15</p> <p>Vocabulary: hypothesis</p> <p>Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.A.1.c</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ENGAGEMENT</p>	<p>View the materials for today's investigation. Pose questions that may be tested using the materials. <i>Possible questions: How does the temperature of water affect the movement of dye throughout the water?, How long does it take for dye to travel through different temperatures of water?</i></p> <p>NOTE: Direct students to recall information from the Posing a Question lesson.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLANATION</p>	<p>Say: Let's explore the following question: How does the temperature of H₂O affect the movement of dye throughout the H₂O?</p> <p>Make a prediction about how the dye will move in each temperature of H₂O.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLORATION</p>	<p>Skills Focus: Developing a Hypothesis</p> <p>Materials: 100 mL of hot water, 100 mL of cold water, dark food coloring</p> <p>Have students put 3 drops of food coloring in the hot water and use a timer or stopwatch to determine how long it takes the food coloring to completely saturate the water. Then have students repeat this procedure with 3 drops of food coloring in the cold water. Have students observe what happens to the food coloring. After observing, have them write a question about their observations. Then, have the class brainstorm a possible hypothesis for their question.</p> <p>Expected Outcome: The food coloring will disperse more quickly through the hot water than the cold water.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLANATION</p>	<p>Teach Key Concepts: Read <u>Nature of Science and Technology</u> p. 15.</p> <p>Focus: Tell students that after posing questions, scientists proceed by focusing on a possible answer to one question in particular.</p> <p>Teach: Ask: What does it mean that a hypothesis is "testable"? (<i>Researchers must be able to carry out investigations and gather evidence that will either support or disprove the hypothesis.</i>)</p> <p>Using <u>Inquiry Skills Activity Book</u> (I for 6th grade, II for 7th grade, III for 8th grade) p. 41 read how to develop a hypothesis. After reading how to develop a hypothesis, go back to the hypothesis the class brainstormed in the exploration and discuss if it is testable and change if necessary. A possible hypothesis could be: <i>If the food coloring is dropped in hot and cold water, then the coloring in the hot water will disperse more quickly.</i></p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ELABORATION</p>	<p>Use <u>Inquiry Skills Activity Book</u> (I for 6th grade, II for 7th grade, III for 8th grade) p. 42-43 to give students an opportunity to practice writing testable hypothesis. After discussing their hypothesis, have students take their science fair question and write a testable hypothesis.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EVALUATION</p>	<p>Teacher observation</p> <p>Discover Activity</p> <p><u>Inquiry Skills Activity Book</u> pp. 42- 43</p> <p>Written Science fair hypothesis based upon prior research</p>	

S.T.E.M. Fair Lesson Plan Day 3

Variables

	<p>Objective: The students will observe the rate of fall of two marbles in order to determine the manipulated, responding, and controlled variables. The students will complete the Skills Practice Activity in order to determine the different variables.</p> <p>Materials: <u>Nature of Science and Technology</u> p. 16-17; <u>Inquiry Skills Activity I, II, III</u> p. 44 -46, 2 marbles of different size, spring scale, towel, ruler (Teacher Demo)</p> <p>Vocabulary: variable, manipulated variable, responding variable, controlled variables</p> <p>Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.A.1.e</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ENGAGEMENT</p>	<p>Give students the following scenario: Suppose you are designing an experiment to determine whether sugar or salt dissolves more quickly in water. What variables would you change? What variable would stay the same? What would be the results of your experiment? (See SA p. 16 of <u>Nature of Science and Technology</u>.)</p> <p>Jane and John wanted to see which paper towel was stronger. Jane used a generic brand and John used a popular brand from a really cool commercial. Water is poured in the middle of both paper towels. Predict which towel will last longer after weights are added to the damp paper towels.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLORATION</p>	<p>BI p. 17 TE Observing Rate of Fall (Teacher Demo) Skills Focus: Controlling variables Materials: 2 marbles of different sizes, scale, towel, ruler Focus: Explain that one of the best-known experiments in history is an experiment by Galileo. He showed that objects of different weights fall at the same rate and hit the ground at the same time. Teach: Follow directions of Teacher Demo with showing students the marbles, weighing the marbles, and having students speculate which will hit the ground first. Repeat experiment several times allowing all students to observe marbles.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLANATION</p>	<p>Teach Key Concepts: Read Nature of Science and Technology pp. 16-17 Focus: Tell students that scientists design an experiment in such a way that an experiment will yield results that will prove or disprove the hypothesis.</p> <p>Teach: Introduce new vocabulary as students read. After students have read the description of the cricket experiment, call on volunteers to share their definition of variable, manipulated variable, and responding variable. Ask: What are the manipulated variable and the responding variable in the cricket experiment? (Air temperature and number of cricket chirps, respectively) Why this is considered a controlled experiment? (Only one variable is being tested – air temperature. All other variables are controlled.</p> <p>Refer students back to the exploration activity. Apply: Ask: What do they think the manipulated variable in this experiment might be? (Marble weight) What do they think the responding variable might be? (Rate of fall) What variables do they think are controlled? (Height of fall, moment fall begins, landing area shape and material of falling objects, air temperature)</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ELABORATION</p>	<p>Use <u>Inquiry Skills Activity</u> (I for 6th, II for 7th, III for 8th) pp. 44-45. Have students read pp. 44-45 to further explain the differences of variables.</p> <p>Students complete Skills Practice p. 46 on Controlling Variables.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EVALUATION</p>	<p>Write the manipulated and responding variables of Jane’s and John’s investigation (from the Engagement). Also, list the variables that need to be controlled.</p>	

S.T.E.M. Fair Lesson Plan Day 4

Research

	<p>Objective: The students will locate information in order to take notes in preparation for writing their research paper.</p> <p>Technology: computers, internet access (Sign out a mobile computer lab if available.)</p> <p>Materials: Reference books from your Library/Media Center</p> <p>Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.A.1.d</p>
<p>NOTE:</p>	<p>If possible, set up a schedule with your Library/Media Specialist so that you can bring your students to the Library for the entire class period to conduct their research. Also, if this happens, you may wish to ask the Library/Media Specialist to pull some books onto a cart for the students if possible.</p>	
<p>ENGAGEMENT</p>	<p>Have students begin a KWLH chart for their S.T.E.M. Fair Topic.</p>	
<p>EXPLANATION</p>	<p>Preparation Note: Review both the location of library references and the structure of the Big 6 Organizer. Point out where the different types of references that the students will use are located in the library Explain to them how many different types of references you wish them to have, i.e. at least one book, website, encyclopedia, and/or magazine. These types will be the easiest for them to locate information. Discourage students from using “wikis” such as www.wikipedia.org as a resource. Information from these sites can be contributed by the general public which may present an issue with credibility.</p> <p>OPTIONAL: Go over how to complete a Big-6 Organizer with the students.</p>	
<p>EXPLORATION</p>	<p>Students will search the library for information to complete their Big-6 Organizer, the KWLH chart, or other organizer that is given by the teacher.</p> <p>The students will conference with their teacher and/or the Library/Media Specialist on how they are doing with their research topics.</p>	
<p>ELABORATION</p>	<p>Bring students back together about 5 minutes before the end of the period.</p> <p>Ask: How could you take your Science Fair Project to the “next level”? What could you do to extend your project? Where in your paper – beginning, middle, or end – would this go?</p>	
<p>EVALUATION</p>	<p>KWLH chart Other organizers given by teacher (Big-6, KWLH, or other)</p>	

KWLH

Topic/Question:	
What do I know:	What have I learned:
What do I want to know:	
How did I find the answer? (Bibliography)	

The Big 6™ Assignment Organizer

Use the following guide to help you organize your research.

Write your topic in the space below:

--

Step 1: Task Definition

What am I supposed to do? (Summarize the project requirements in this space.)

What questions do I need to answer to complete my task? (You should always have a minimum of six questions to answer when completing research about a topic.)

1	
2	
3	
4	
5	
6	

Step 2: Information Seeking Strategies

What types of sources will I use to find the information I need? (Look at the questions you wrote in Step 1 and think about the project requirements before filling in this area.)

1		5	
2		6	
3		7	
4		8	

Step 3: Location and Access – Locate sources and the information within them.

Where can I access my sources of information? (You may have to work on this project on your own time.)

	School library
	Computer lab
	Public library
	Home
	Other:

Key words or search terms I will use to find information:

Step 4: Use of Information – Use a source to gain information.

How will I record the information I find?

You will use a KWLH chart to record the information you find when answering the questions you wrote in Step 1. As you complete your research, you may find that your first questions do not yield enough information. Use the W column of your KWLH chart to add questions to your research plan.

How will I keep track of the sources I use?

You will credit the sources you use for projects using a bibliography. You will credit your sources using the format provided by your librarian or teacher. See the "Writing a Bibliography" sheet for examples of various types of entries. If you need additional help writing your bibliography, please ask your librarian or teacher.

Step 5: Synthesis – How will I show my results?

You will show your work in the format assigned by your teacher. Rubrics will be provided to you that detail how your project will be graded. If you have questions about your work, please see your librarian or teacher.

The Big 6™ Assignment Organizer

Use the following guide to help you organize your research.

Write your topic in the space below:

How fast does an earthworm burrow in different types of soil?

Step 1: Task Definition

What am I supposed to do? (Summarize the project requirements in this space.)

Complete a science experiment; complete research for a written report;

make a display board; Make charts and graphs to show my data;

write a bibliography of the sources I use

What questions do I need to answer to complete my task? (You should always have a minimum of six questions to answer when completing research about a topic.)

1	<i>How do earthworms move?</i>
2	<i>Where do earthworms live?</i>
3	<i>Why do earthworms come out of the ground when it rains?</i>
4	<i>What do earthworms eat?</i>
5	<i>Do earthworm burrows help or hurt the earth?</i>
6	<i>What are earthworm burrows made of?</i>

Step 2: Information Seeking Strategies

What types of sources will I use to find the information I need? (Look at the questions you wrote in Step 1 and think about the project requirements before filling in this area.)

1	<i>Books</i>	5	<i>Magazine articles (from SIRS)</i>
2	<i>Encyclopedias</i>	6	
3	<i>Internet sites</i>	7	
4	<i>Databases</i>	8	

Step 3: Location and Access – Locate sources and the information within them.

Where can I access my sources of information? (You may have to work on this project on your own time.)

X	School library
X	Computer lab
X	Public library
X	Home
	Other:

Key words or search terms I will use to find information:

<i>Earthworms</i>		
<i>Burrows</i>		

Step 4: Use of Information – Use a source to gain information.

How will I record the information I find?

You will use a KWLH chart to record the information you find when answering the questions you wrote in Step 1. As you complete your research, you may find that your first questions do not yield enough information. Use the W column of your KWLH chart to add questions to your research plan.

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You will credit the sources you use for projects using a bibliography. You will credit your sources using the format provided by your librarian or teacher. See the "Writing a Bibliography" sheet for examples of various types of entries. If you need additional help writing your bibliography, please ask your librarian or teacher.

Step 5: Synthesis – How will I show my results?

You will show your work in the format assigned by your teacher. Rubrics will be provided to you that detail how your project will be graded. If you have questions about your work, please see your librarian or teacher.

Step 6: Evaluation

Before turning in your project, be sure you can check off **all** of the following items:

	The information I found in Step 4 matches the information I needed in Step 1.		I have compared my work to the rubrics provided and am earning the grade I deserve.
	Credit is given to my sources of information, written in the format required.		My work is neat and complete.
	I am in compliance of copyright laws and fair use guidelines.		I would be proud for anyone to view my work.

Once you have turned in your project, complete the checklist your teacher gives you and respond to the following BCR.

Think about what you did to complete this project. Now, think about how you can change what you did so that you can be more successful completing your next project. What did you do well? What will you do differently next time? Write your response in the space below.

Middle School Science Fair Assignments and Due Dates

Listed below is the sequence of events that lead to a successful science fair project. As you work through the assignments below, your science teacher will record the points you earn in this table.

The grading scale for this project is as follows:

A	B	C	D	E
200-180 points	179-160 points	159-140 points	139-120 points	119 points and below

To be turned in...	Date Due	Points Available	Points Earned
Three project ideas and signed contract.		10	
Hypothesis.		10	
Materials and Procedures.		10	
Steps 1-3 of the <i>Big6</i> Organizer.		10	
Research notes check 1 (Step 4 of the <i>Big6</i>).		10	
Research notes check 2 (Step 4 of the <i>Big6</i>).		10	
Data and Conclusions from experiment (Step 4 of the <i>Big6</i>).		40	
Research report and bibliography rough draft (Step 5 of the <i>Big6</i>).		20	
Display board (Step 5 of the <i>Big6</i>).		20	
Research Report (Step 5 of the <i>Big6</i>).		40	
Two copies of the bibliography (Step 5 of the <i>Big6</i>).		20	
TOTAL POINTS		200	

- If an assignment is not turned in on the due date, full credit will not be awarded, only partial credit will be given.
- Students found to have committed plagiarism on the research report will automatically lose one letter grade at the end of the project.

Science Fair Lesson Plan Day 5
Writing a Bibliography

<p>Objective: The students will review requirements of the research paper in order to prepare for writing their research paper. Materials: Reference books from the Library/Media Center Technology: computers, internet connection (try to sign out a mobile computer lab, if available) Vocabulary: bibliography Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.A.1.d</p>
ENGAGEMENT	<p>Brainstorm the types of resources that can be used to research a topic. Use a graphic organizer to display your thoughts.</p>
EXPLORATION	<p>Place the students into pairs or small groups. Have one copy of each of the sample papers available for each group. Explain to them they will be going on a scavenger hunt for information about how the paper is set up (you will have skimmed the papers for the scavenger hunt prior to this activity). Each group of students will have about 10 minutes to complete the scavenger hunt.</p>
EXPLANATION	<p>Have a copy of "Writing a Bibliography" for each student to use and go over how to write a bibliography. Point out the various types of resources.</p>
ELABORATION	<p>Provide each group of students with a set of reference materials of various forms (books, magazines, newspaper articles, websites, etc.) to create a practice bibliography. Students will use "Writing a Bibliography" to write the references in the correct form. Even though the book may not be related to the students' science fair project, this will serve as good practice.</p> <p>Go over the first two with the class as a whole, and then collect the papers from the students.</p>
EVALUATION	<p>Have students begin research for their approved topics. They should maintain a bibliography as they conduct their research.</p>
NOTE:	<p>The example papers and bibliography page were taken from the Science Fair Student Journal, PGIN 7690-3634. You can order this from the warehouse/printing services.</p>

Name _____

Date _____

Teacher _____

Mod _____

Scavenger Hunt

1. How was the question that was researched for Science Fair presented in Example 1 and Example 2? Be specific about what was different or the same in each paper.

2. Was background information included in both examples? Why do you think that was done?

3. How was the main body of the research paper presented in each paper? What were the differences and similarities? Do you think the way that one of the papers is set up is better than the other? Explain your thinking.

4. What are some things that you notice about the bibliography page of each example paper? How many different types of resources were used for each example?

This is the title page. It is the first requirement of the research paper.

Title of Project

TRUTH DECAY

(Sample Research Paper 1)

Subtitle gives additional understanding of topic

THE TRUTH ABOUT TOOTH DECAY

Student Name

Schntae Graham

School

Greenbelt Middle School

Teacher Name

Sixth (6th) Grade

Grade level

Teacher: Ms. Davis

Date due

December 17, 2007

Notice the student was specific with type of help received.

Acknowledgements

This page acknowledges the help that the student received in doing the project. It is the second requirement of the research paper.

I would like to thank my Mom for helping me with this project and typing the information, because it was taking me forever. Special thanks to Ms. Ward and Ms. Casbourne for encouraging me to do the project. I wanted to change projects because things weren't working the way I thought.

Both the question and research are on the same page of this research paper.

QUESTION

The Science Fair question is the third requirement of the research paper.

To find out, if you let an egg sit in lemonade, Coca-Cola, Diet Coke, orange juice or water for seven days, what effect will it have on the egg?

The first two paragraphs are the introduction to the topic.

RESEARCH

Background research about the topic is the fourth requirement of the research paper.

This research paper and science project taught me a lot about why my Mom always asks, "Did you brush your teeth?" I hear it every day. I see that it is important to brush your teeth, eat well and visit the dentist. That's why this project is titled, TRUTH DECAY. This paper will give you a better understanding about why our teeth are important, how tooth decay begins, and how to prevent tooth decay.

This sentence tells the specific ideas that will be covered in this research paper.

Tooth decay can start at any age. While we are young, we should take good care of our teeth. I do not like to go to the dentist but my mom makes me go at least two (2) times a year. My mom says it is important to go to the dentist, so when you get older you won't have a lot of problems with your teeth and spend a lot of money.

What Are Teeth Made Of?

The student organized the research information by writing important questions as headings and then answering the questions from research.

The white covering on teeth is called enamel. The function of the enamel is to protect the tooth from damage and pain. Under the outer covering of enamel, is a hard, yellow substance called dentin. Most of the tooth is made up of dentin.

What Is Tooth Decay?

Tooth decay is a bacterial disease of the teeth. This decay is the primary source of tooth loss in people no matter what their age is of a person.

Important,
interesting fact

Why Do You Get Tooth Decay?

Tooth decay happens when bacteria, sugary foods, and a target tooth surface work together or react against each other. Our mouths contain lots of bacteria. We eat a lot of different foods at different times of the day; therefore, the bacteria convert some of the sugary foods to acid. The bacterium that grows on our teeth is called plaque. Plaque is the sticky coat that forms on the outside of our teeth. When you don't clean or brush your teeth regularly, plaque will build. Bacteria eat through the outside of the teeth or what is called tooth enamel; this makes the tooth surface soft. Once the bacteria get through the enamel of a tooth, tooth decay can make a tiny cavity or little hole in the tooth. You can tell when you have a cavity because something cold (ice cream), hot (soup) or sugary (candy) may cause you to get a toothache or your teeth may feel tender. When this happens tell a parent so you can go to the dentist.

Important
Definition

Detailed
explanation

Gives
real

Why Was An Egg Used In The Experiment?

This question and answer make the connection between the research and the science experiment.

A hard-boiled egg was used because this is the closest model of your teeth. The damage to the egg during the experiment is in relation to the damage that can be done to your teeth.

How Do You Prevent Tooth Decay?

This paragraph gives three very important ways to prevent tooth decay with supporting details.

To prevent tooth decay, it is important to brush your teeth regularly. Brushing is not just to make sure that your teeth are clean, but to remove plaque that builds on your teeth and causes tooth decay. You should brush more than just once a day. Books and articles suggest that you brush after every meal. Use fluoride toothpaste. Fluoride helps protect your teeth from tooth decay. Visit the dentist at least twice a year. The dentist checks for problems. The dentist may prevent small problems from getting out of control. Tooth decay may take several months to happen, but modern technology, like an x-ray, will show small problems.

Our teeth must last a lifetime. One or two cavities may not seem like a big deal, but your teeth tell a lot about you. If you have rotten teeth, you may not smile a lot or it may cause you embarrassment. Now that you know what “TRUTH DECAY” is, let’s get busy and brush “TOOTH DECAY” away.

This paragraph is the conclusion. It ends the paper with an appeal to readers to make good use of the information provided. This is one good strategy for writing a conclusion.

BIBLIOGRAPHY

Listing website resources can be tricky because all the same information is not always available. Always give as much information about the website as you can.

This is the bibliography page and it is the fifth and final requirement of the research paper. Notice that the sources are listed in alphabetical order by author's last name.

Dr. Green website. 2000-2002. Online. 20 Jan. 2002. Available:
[http:// www.drgreene.com](http://www.drgreene.com).

Name of website

Website address

Day you went to the website. This is important because the Internet information is always changing.

Silverstein, Alvin and Silverstein, Virginia. Tooth Decay and Cavities.
Danbury: Grolier Publishing, 1999.

Stay, Flora Parsa. DDS. The Complete Book of Dental Remedies.
Garden City Park: Avery Publishing Group, 1996.

Ward, Brian R. Dental Care. New York: Franklin Watt, 1986.

Copyright date

Author name is written with the last name first

Title of book is underlined

City in which book was published

Name of publisher

This student used three books and one website as resources for the research found in this paper.

This is the title page. It is the first requirement of the research paper.

What is the Effect of Thermal Inversion on Air Pollution?

(Sample Research Paper 2)

Student Name

Venetta L. Bronson

School

Greenbelt Middle School

Teacher Name

Grade 6

Grade level

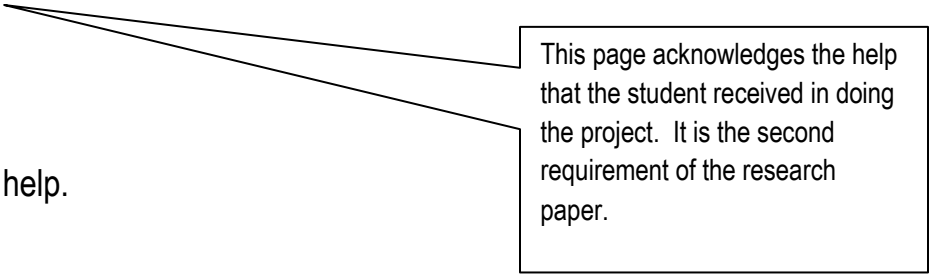
Mrs. Behnfeltdt

Date due

December 17, 2007

ACKNOWLEDGEMENTS

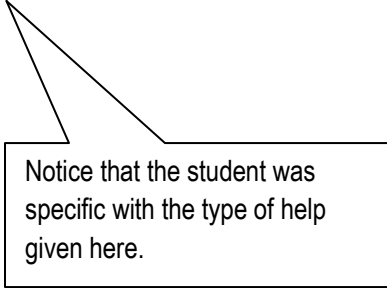
Thanks Mom for all of your help.



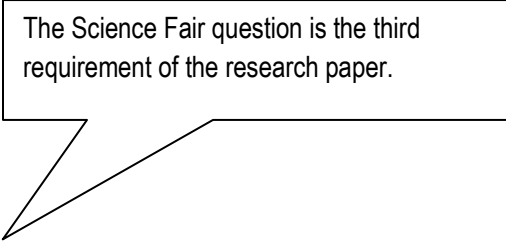
This page acknowledges the help that the student received in doing the project. It is the second requirement of the research paper.

Thanks Ms. Casbourne for the Science Fair “make and take.”

Thanks Mrs. Behnfeltdt for helping me with my corrections.

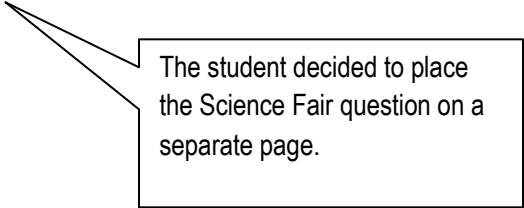


Notice that the student was specific with the type of help given here.



The Science Fair question is the third requirement of the research paper.

Question: What is the Effect of a Thermal Inversion on Air Pollution?



The student decided to place the Science Fair question on a separate page.

Background Information

Background research about the topic is the fourth requirement of the research paper.

Air and water are essential to life. Air pollution is caused when chemical substances are released into the atmosphere that are not normally found there. Polluted air can cause or lead to lots of health problems in people. ~~It can also harm plants and animals.~~

This paragraph introduces the topic of pollution and tells why it is important.

Smog, the dark haze in the air (smoke and fog) is the most common form of air pollution. It is a major problem for many cities in the world. Polluted air is dirty air. It can make the air smell bad and can make things ~~dirty~~. It can rise up into the atmosphere and be carried away for many miles by the winds. This is ~~the~~ polluted air.

This paragraph gets more specific and focuses on one type of pollution.

Many activities of human beings pollute the air. People pollute the air by allowing chemicals, poisonous ~~gases~~, and tiny particles of dirt to get into the air.

This paragraph tells what causes this type of pollution.

My Science Project

Student decided to add a separate heading for more background research as it is related to the project.

My science project is about the effect of a thermal inversion on air pollution. A thermal inversion occurs when hot air is above colder air. Hot air rises and cold air falls. If the cold air is nearer to the ground, there will be no mixing of air. This still air has no wind to carry away the pollution particles.

This paragraph makes a connection between the research and the experiment.

Important definition

A thermal inversion traps air near the ground. Pollution molecules build up in the air if there is no wind to carry them away from the city or rain to wash them out of the air. An example of how pollution and smog can be deadly, is in Donora, a small town in Pennsylvania. In October 1948, 6,000 people in a town of 14,000 got sick, and 20 died from pollution and smog so thick people couldn't see across the street.

Important definition

Uses important, real fact to provide an example.

Smog is a combination of smoke and fog. A lot of the pollution molecules you cannot see. However, sometimes you may see smoke combine with fog to produce smog. Estimates of deaths from pollution caused by still air, a build-up of smog, and pollution include: 650 people in London in 1872; 400 people in New York City in 1963; and 4,000 people in London 1952 during five days of smog.

More examples using real facts and data that are important to understanding the topic.

We cannot control the weather or prevent thermal inversions from occurring, but we can reduce the pollution that causes smog. We can drive more fuel-efficient cars. We can

Final paragraph is a conclusion that offers ways to deal with the problem presented in topic.

use devices to help stop pollution molecules from being released from cars, factories and power plants.

This paragraph gives a quick summary of the background research.

Conclusion

Student decided to include the conclusion of the actual experiment with the research paper. This is an excellent idea but it is not a requirement of the research paper.

This process of warm air rising and cold air falling keeps the air moving and helps carry pollution away from its source. A thermal inversion occurs when hot air is above colder air. Hot air rises and cold air falls. If the cold air is nearer to the ground, there will be no mixing of air. This "still" air has no wind to carry away the pollution particles. A thermal inversion traps air near the ground.

My hypothesis proved incorrect. I predicted that the hot air smoke would not rise out

and the cold air would rise. I also predicted that a thermal inversion would have no effect on the air pollution at all. (stay in the bottom of the bottle)

the air pollution at all.

Restates hypothesis and tells whether it is correct or not

In doing my experiment, I observed that the cold air smoke stayed in the bottom of the bottle for a long time before it disappeared. At no time did it rise to the top. I was so sure that the hot air smoke would not rise; instead it would stay in the bottom of the bottle.

However, it seemed like once I dropped the match into the bottle with the hot air smoke, I saw the smoke rise up to the top of the bottle and then it disappeared. I repeated this experiment six times. Each time I got the same results.

Repeated trials

Mentions problems that occurred during the experiment

that sometimes the match would go out before I could get it to the bottle. I think this

happened because I was scared of the fire. I was afraid I might get burned, but my mom said she wouldn't let that happen.

I'd like to try this experiment with a watch instead of a timer. I could check the amount of smoke in the bottles every minute to see if there was

Discusses changes that could be made if the experiment was done again

All of the resources used for this paper were books.

Bibliography

Bender, David and Leone, Bruno. The Environment Opposing Points. San Diego: Greenhaven Press Inc., 1996.

This is the bibliography page and it is the fifth and final requirement of the research paper. Notice that the sources are listed in alphabetical order by author's last name.

Brower, Michael and Leon, Warren. The Consumer's Guide to Effective Environmental Choices. New York: Three Rivers Press, 1999.

Chandler, Gary and Graham, Kevin. Protecting Our Air, Land and Water. New York: Henry Holt and Company Inc., 1996.

This source is listed alphabetically

Current Controversies: Pollution. San Diego: Greenhaven Press Inc., 1994.

Ehrlich, Anne H. Betrayal of Science and Reason. Washington, D.C.: Island Press, 1996.

McCormick, John. Acid Rain. New York: Gloucester Press: 1991.

This is the source where the project idea came from.

Morgan, Sally. The Ozone Hole. Danbury: Franklin Watts, 1996.

Redalia, Debra Dadd. Sustaining the Earth. New York: Hearst Books, 1994.

Rybolt, Thomas R. and Mebane, Robert C. Environmental Experiments About Air. New Jersey: Enslow Publishers Inc., 1993.

Copyright date

Stille, Darlene R. Air Pollution. Chicago: Children's Press, 1990.

Name of publishing company

Author's name listed with last name first.

Book title is underlined.

City where book was published.

Writing a Bibliography

When you write a bibliography, you are listing all of the sources of information you used to write your paper in alphabetical order. For the different types of sources, follow the examples listed below.

BOOKS

Author (last name, first name). Title of the book. City where book is published: Publisher, Copyright date.

Tillerman, Jon. The Way the Earth Moves. Chicago: McMillian, 1998.

MAGAZINES

Author (last name, first name). "Title of the article." Title of Magazine Date (day month year): page numbers of article.

Smith, Sarah J. "Why Don't We Fall from Rollercoasters?" Science News 8 July 2000: 77-79.

ENCYCLOPEDIA

"Article Title." Title of Reference book. Edition (if available). Year published.

"Microscopes". Encyclopedia Britannica. 1996.

FILMS, SLIDES, or VIDEO TAPES

Title. Medium (state if it is a film, slide, video tape, laser disc etc). Production company, date. Time length.

Under the Microscope- Amoebas. Videocassette. Science and Kids Productions, 1994. 15 minutes.

INTERVIEWS

Person you interviewed (last name, first name). Type of interview. Date.

Aberwitz, Shelly. Personal interview. 20 Sept. 2002.

ONLINE SOURCES (Websites)

Author (last name, first name – if there is one) "Title of Article". Title of Website or Publication. Date of Publication (or last update). Online - date of access (when you went to website). Available website address.

"Deserts". BrainPop. 2002. Online. 13 May 2002. Available:

<http://www.brainpop.com/science/ecology/desert/index.weml>

S.T.E.M. Fair Lesson Plan Day 6

Interpreting Data

	<p>Objective: The students will measure their feet and construct a data table and a graph in order in order to interpret data to answer a question.</p> <p>Materials: <u>Inquiry Skills Activity I, II, and III</u>; <u>Nature of Science and Technology</u> textbook paper, student's foot, pencil, metric ruler, scissors</p> <p>Technology:</p> <p>Vocabulary: data, interpret</p> <p>Pacing: 1 class day</p>	<p>State Standards Gr6 -8.1.A.1.h Gr6 -8.1.C.1.a Gr6 -8.1.C.1.b</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ENGAGEMENT</p>	<p>NASA scientists believe that the Phoenix Lander has uncovered ice in the arctic north of Mars. What did they use to determine this finding? (<i>photographs and other information sent back the Phoenix Lander</i>)</p> <p>Have students brainstorm other methods of collecting data. (<i>recording observations, collecting measurements such as temperature, distance, time, etc.</i>)</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLORATION</p>	<p>Who Has The Largest Feet, Boys or Girls? Skills Focus: Interpreting Data Materials: paper for tracing foot, student's foot, pencil Procedure: Have students hypothesize who has the largest feet. Next, have the students trace their right foot on a piece of paper. Cut out the traced shoe and measure it using a centimeter ruler. Write their name and length of foot on the front and tape to chalkboard in order of size. Boys in one section and girls in another. After looking at the cutouts, students decide who has the largest feet.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLANATION</p>	<p>Teach Key Concepts: Organizing Data and Graphing Results. <u>Nature of Science and Technology</u> p. 18 Focus: Tell students that a good controlled experiment yields quantitative observations that can be recorded in a table or a graph. Teach: Ask a volunteer to read the definition of data, and then direct students' attention to Figure 10. Ask: What data were gathered in the cricket experiment? (<i>The number of cricket chirps per minute.</i>) For what purpose were these data gathered? (<i>To test the hypothesis that cricket chirping increases at higher temperature</i>) Emphasize that recording data in a data table is a good way of organizing the data in anticipation of drawing a conclusion about the hypothesis.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLORATION</p>	<p>Constructing Data tables and Graphs Use the information from the 1st exploration and construct a data table to show the number of feet for a particular size for both boys and girls. Next, have students construct a bar graph using information in the data table. Have students look for trends, patterns, etc. in the graph and data table. Using the information they have gathered, the students should be able to determine who exactly has the largest feet.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ELABORATION</p>	<p>Use <u>Inquiry Skills Activity Book</u> (I for 6th, II for 7th, III for 8th) pp. 50-51 Read pp. 50-51 together. Have students complete the Skills Practice on p. 52 to give them further practice in interpreting data.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EVALUATION</p>	<p>Create a rubric to score the data table and graph for today's investigation.</p> <p>A basic data table rubric may include: a title, column and row labels, information from all trials, and appropriate units. A basic graph rubric may include: a title, labeled axes, plotted data, and a key (if necessary).</p>	

S.T.E.M. Fair Lesson Plan Day 7

Drawing Conclusions

	<p>Objective: The students will design an experiment in order to draw conclusions about whether their data supported their hypothesis.</p> <p>Materials: <u>Nature of Science and Technology</u>; <u>Inquiry Skills Activity I, II, or III</u>; 3 sheets of paper, watch or clock with second hand (per group)</p> <p>Technology:</p> <p>Vocabulary: conclusion</p> <p>Pacing: 1 class period</p>	<p>State Standards Gr6 -8.1.B.1.d</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ENGAGEMENT</p>	<p>According to the National Weather Service, the average temperatures for the Washington, DC area for the month of January was 40°F, February was 41°F, March was 49°F, April was 58°F, and May was 64.7°F.</p> <p>What conclusions can you draw from this information? <i>(The temperature is getting warmer therefore the Washington, DC area must getting more direct sunlight and going from winter into spring.)</i></p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLORATION</p>	<p>TT p. 19 Nature of Science and Technology</p> <p>Skills Focus: Drawing conclusions</p> <p>Materials: 3 sheets of paper, watch or clock with second hand (per group)</p> <p>Time: 15-20 minutes</p> <p>Expected Outcome: Gravity causes objects to fall at the same rate unless another force opposes that downward motion, such as air resistance. The crumpled sheet of paper will fall at about the normal rate, but air resistance will cause the unfolded sheet to fall much slower. The paper folded in fourths will likely fall at a rate between the other two. Possible hypothesis: The crumpled sheet of paper will fall fastest. A typical experiment will involve dropping the different sheets from the same height in the same condition.</p> <p>Ask: Does your data support your hypothesis?</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EXPLANATION</p>	<p>Teach Key Concepts: <u>Nature of Science and Technology</u> pp. 19-20</p> <p>Focus: Tell students that the purpose of gathering data from an experiment is to draw a conclusion about whether the hypothesis was accepted or rejected and why. A proper conclusion should also include actual data (usually numerical information) as support for the acceptance or rejection.</p> <p>Teach: Ask: What was the hypothesis of the cricket experiment designed to test? <i>(Cricket chirping increases at higher temperature.)</i> Was the hypothesis supported? <i>(yes)</i> What do you base your conclusion on? <i>(An interpretation of data shown in Figure 10.)</i></p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ELABORATION</p>	<p><u>Inquiry Skills Activity</u> (I for 6th, II for 7th, III for 8th) pp. 53-55</p> <p>Have students read pp. 53-54 about drawing conclusions.</p> <p>For practice, have students complete the Skills Practice on p. 55.</p>	
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">EVALUATION</p>	<p>Have students use the data from the paper experiment to write a conclusion.</p>	