

Inquiring Minds Want to Know

By **Lori Hypes** for Blue Ridge Public Television (WBRA, WMSY, WSBN)
Tazewell Middle School, Tazewell, VA

GRADE LEVELS:

5th – 8th grades

TIME ALLOTMENT:

3 – 45 minute blocks

SUBJECT MATTER:

Science/Language Arts

OVERVIEW:

This lesson focuses on inquiry learning. The students will define scientific inquiry based on the information they gather in a United Streaming Video and their research. Students will have fun as they help design an experiment in identifying a number of mystery powders. An interactive web site will awaken their curiosity as they investigate a number of topics such as: the Moving Man, SpiroGraph design, and Moon Phases, just to name a few. After all, “Inquiring Minds Want to Know!”

LEARNING OBJECTIVES:

Students will be able to:

- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, and predictions.
- Think critically and logically to make relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.

STANDARDS:

State Standards:

The objectives listed may be used in part to address the Virginia Standards of Learning at <http://www.pen.k12.va.us>

- VA SOL Science, 4.1, 5.1, 6.1, 7.1, 8.1, CH.1
- VA SOL English, 4.7, 5.8, 6.6, 7.8, 8.7

MEDIA COMPONENTS:

- Computer
- TV
- United Streaming Video: *What is Scientific Inquiry?*

- Web Site:
<http://www.ba.infn.it/~zito/museo/leonardo.html>

Leonardo: Interactive Virtual Science Museum.

At this website students will investigate two topics of their choosing: the Moving Man and SpiroGraph design. Students will manipulate variables and observe the consequences of their actions. These sites will arouse curiosity and encourage students to ask questions and pursue an answer.

MATERIALS :

Materials needed for Introductory Activity:

- 1 tall skinny glass (8 to 10 fluid ounces)
- 1 bottle of Instant Snow Polymer \$5.00 (Order from: Educational Innovations, 362 Main Avenue, Norwalk, CT 06851 Phone 203-229-0730)
- 1 cup of ice cold water
- Container to catch the overflow
- 1 pint or quart sized clear plastic container
- Enough water to fill the container
- 1 bottle of Magic Sand (Order from: Educational Innovations, 362 Main Avenue, Norwalk, CT 06851 Phone 203-229-0730)
- 1 plastic plate to pour the Magic Sand onto after you have poured off the water

Materials needed for Learning Activity:

- Computer(s)
- Television
- VCR
- Pencil
- Goggles and gloves for each student

For Each Group:

- 4 film canisters labeled A, B, C, D
- 5 toothpicks (used to stir the powders)
- 5 eye droppers
- 4 white powders testing powders (cornstarch, pickling lime, cream of tartar, baking soda)
- 5 reactants (water, white vinegar, red cabbage juice, hydrogen peroxide, iodine)
- 1 sheet each of white and black construction paper laminated (used to place under the template so students may observe color of substance on two backgrounds)
- 4 McDonald's coffee stirrers (used to acquire a sample from the canisters)
- One hand held lens

Handouts

- Data Recording Sheet
- Lab Sheet 1-A, 1-B, 1-C, 1-D that have been made into transparencies
- 1 Reaction Lab Chart

- 1 Mystery Powder Identification Chart
- 1 Newspaper Article Directions
- Website Investigation Worksheet

PREPARATION FOR TEACHERS:

- ✓ Prior to teaching the unit, bookmark the Web sites.
- ✓ Cue the video to the place to start the lesson.
- ✓ Make sure you go through the instructions from the student materials handouts to make certain that you understand and are familiar with the lesson format and what the students need to do or understand for the lesson.
- ✓ When using media, always provide the students with a *Focus for Media Interaction*, which is a specific task to complete during or after viewing video segments, Web sites, or other media material.
- ✓ Boil a few leaves of red cabbage in distilled or tap water to make purple juice to use as an indicator for pH. (Four or Five leaves to 1 or 2 cups of water.) Strain the juice and place in refrigerator up to 5 days before use.
- ✓ Help students develop a descriptive vocabulary list if necessary to help them with the observation part of the lesson. Examples: fizzy, milky, chalky, foamy, opaque, bubbly, dull
- ✓ Go over lab safety rules if you have not done so already.
- ✓ Copy handouts.
- ✓ Make transparencies of certain handouts.
- ✓ Order Magic Sand and Instant Snow Polymer if you choose to do these demonstrations.

INTRODUCTORY ACTIVITY: SETTING THE STAGE

1st Day

When students come into class have two “wow” demonstrations to show them to pique their curiosity. These demos will motivate students to ask questions such as: How did you do that? What caused that to happen? *Note: Do not feel like you have to answer the questions, but rather challenge the students to find out on their own.

Demo #1: 1 slightly tall skinny glass (8 or 10 fluid ounces)

1 bottle of **Instant** Snow Polymer

1 cup of ice cold water

Container to catch the overflow (8 to 10 fluid ounces)

Say, “I’m going to make snow from this substance and water.” You can pass around a dry sample of the polymer. Put 1 tablespoon of the polymer in the glass. Add enough cold water to fill the glass. Watch the student’s amazement as the polymer begins to absorb the water and spill over the side of the glass. (Students will start asking questions wanting to know how so much “snow” was made from such a tiny amount of substance.)

Demo #2: 1 pint or quart sized clear plastic container

Enough water to fill the container

- 1 bottle of Magic Sand
- 1 plastic plate to pour the Magic Sand onto

Fill the plastic container about 2/3 full of water. Drop about ¼ cup of Magic Sand into the water. Allow students time to observe. Pour the water out of the jar, leaving the sand. Pour the sand onto a paper plate. Allow students time to observe. (Students should start asking questions immediately wanting to know why the sand is dry and not wet.)

LEARNING ACTIVITIES

Note to teacher: Have the United Streaming Video, “What is Scientific Inquiry?” ready before class starts.

1. **Focus for Media Interaction:** Say, “We are now going to watch video segments that explain the world of scientific inquiry. When this segment is over, I want you to tell me what does all scientific inquiry start with and what is the question that the young man gives as an example?” **Start** United Streaming Video *How Scientists Work Series, What is Scientific Inquiry?* at (4:30) just after the word *Investigation* appears on the screen. **Pause** when the screen goes black (5:07). **Ask**, “What does all scientific inquiry start with?” (All scientific inquiry starts with a question.) **Ask**, “What is the question the young man gives as an example?” (Is the planet really warming up?) *Note: Lead students into other questions that inquiring minds want to know. Ex: Why is the grass green? Why does the ball bounce? Why do some things sink while others float?”
2. **Focus for Media Interaction:** Say, “In this next segment I want you to tell me what the narrator says that scientific inquiry is like and what does a detective do to solve crimes.” **Resume** video and **Pause** just after you see a man dialing a telephone and you hear the narrator say “... and the answer to the question, *Who Done It?*” (5:27) **Ask**, “What does the narrator say that scientific inquiry is like? (Sherlock Holmes trying to solve a crime.) “What does a detective do to solve crimes?” (Looks for clues, asks hard questions and finds evidence.)”
3. **Focus for Media Interaction:** Say, “Now, I want you to tell me what is the major part of scientific inquiry and what is the culprit of scientific inquiry?” **Resume** and **Pause** when you see a man removing a nose piece and hear “... a question which points to an unknown”. (5:40) **Ask**, “What is the major part of scientific inquiry?”(It is the investigation.) “What is the culprit of scientific investigation?” (The unanswered question.)”
4. **Focus for Media Interaction:** Say, “In this next segment I want you to tell me what question is asked and how will they do the investigation to find the answer?” **Resume** and **Pause** when you see a calendar and hear the narrator say “...to check the trees weekly as the year unfolds.” (6:02) “What question was asked?” (When did the buds form?) “How will they do the investigation to find the answer?” (They will check the trees weekly.)

5. **Focus for Media Interaction:** Say, “This time I want you to watch this segment and tell me when the buds form?” **Resume** and **Pause** when you see an enlarged circle with tree buds and the word November and hear the narrator say “...trees with buds but no leaves and it’s winter again.” (6:48) “When do the buds form?” (August)
6. **Focus for Media Interaction:** Say “This time I want you to tell me what two things the investigation revealed?” **Resume** and **Pause** when you see a faded picture of a tree and hear the narrator say “...any question that gets us started.” (7:31) “What two things did the investigation reveal?” (When the buds forms on trees, and the yearly life cycle of the tree.)
7. **Focus for Media Interaction:** Say, “In this next segment I want you to tell me what two things are most important about scientific inquiry?” **Fast Forward** video to where you see a fossil getting an MRI (18:43) **Resume** and **Stop** just after the screen goes black. “What are the two most important things about scientific inquiry?”(Using your curiosity and being persistent in trying to find an answer.) (19:35)

2nd Day

Mystery Powder Experiment

Say, “Today you are going to help solve a mystery, testing four mystery powders.”

1. At this time, pass out and follow the instructions on worksheet entitled *Data Recording Sheet Instructions*.
2. When you have completed your tests on all four powders raise your hand and the teacher will give you your next assignment. (*Mystery Powder Chart* and *Mystery Powder Chart Directions*)
3. After you have completed the Mystery Powder Chart, raise your hand and the teacher will give you your next assignment: Writing a Newspaper article. Give worksheet *Newspaper Article Directions*.

CULMINATING ACTIVITY

(3rd Day)

Bookmark the web sites: <http://www.ba.infn.it/~zito/museo/leonardoen.html>

Leonardo: Interactive Virtual Science Museum. You can access the two websites from this one website. I have given you the individual websites if you do not want to go through the Science Museum. Give each student or each pair of students *Website Investigation Worksheet*.

<http://www.math.dartmouth.edu/~dlittle/java/SpiroGraph/> At this website, you can manipulate variables and produce a Spiro Graph

<http://www.mste.uiuc.edu/users/Murphy/MovingMan/MovingMan.html> At this interactive site, students can predict and then test their predications about the kind

of graph they will produce based on the velocity and acceleration of the “moving man”.

CROSS-CURRICULAR EXTENSIONS

Science:

Find the pH of various substances.

Use five senses to identify harmless substances.

Use isolated senses to identify substance such as objects in a bag.

Develop an assessment tool to be used to collect data.

Art:

How is Art cleaned? (What chemicals are used?)

What are different painting mediums that painters use made of?

Math:

Probability

Predict future trends by examining past and present trends. (Graphs)

Interrupting patterns

Social Studies:

Predict future trends by examining past and present data.

Examine future population growth

Examine past, present, and future of food production.

COMMUNITY CONNECTIONS

Police Investigator can bring various crime scene test kits to show to students. Ex.: Dust for finger prints.

Local Hazmat Officer can explain the process for transporting chemicals as well as their clean up and disposal.

Doctor or Nurse could discuss medications that look alike and how this situation is handled.

Have students watch an episode of CSI and outline the method used to solve the case.

Have a city planner discuss how a city must plan for a growing and changing population.

Data Recording Sheet Instructions

Materials needed for this lab:

- 4 film canisters labeled A, B, C, D
- 5 toothpicks (used to stir the powders)
- 5 eye droppers
- 4 white powders testing powders (cornstarch, pickling lime, cream of tarter, baking soda)
- 5 reactants (water, white vinegar, red cabbage juice, hydrogen peroxide, iodine)
- 1 sheet each of white and black construction paper laminated (used to place under the template so that students may observe color of substance on two backgrounds)
- 4 McDonald's coffee stirrer sticks
- One hand held lens
- Gloves for each person in the group
- Goggles for each person in the group
- 1 each per group of worksheets:
 - Lab Sheets 1-A, 1-B, 1-C, 1-D that have been made into transparencies
 - 1 Data Recording Sheet
 - 1 Reaction Lab Chart
 - 1 Mystery Powder Identification Chart
 - 1 Newspaper Article Directions

1. Collect the materials listed above according to teacher's directions.
2. You will place your powders on the Reaction Lab Sheet, one at a time. Example: Locate vial A. Use stirrer stick to take five samples of the powder out and place inside the circles in column one on the chart. Rotate placing white and black construction chart underneath.
3. Using Lab Sheet 1-A, record your observation and predictions. Use the hand held lens and look at the powder. Make a prediction as to what you think will happen as you add the test liquids to the powder.
4. Now, on the Reaction Lab Chart, add a few drops of water to the first circle, and record your observations in results column on Lab Sheet 1-A.
5. Repeat steps 2 through 5 rotating through all the vials A, B, C & D. Note: As you finish all tests for powder A, take a paper towel and wipe off the powder and test liquids onto a paper plate designated to receive this as waste. Remember to wipe to the left so as not to contaminate the sheet on the right. At the end of the class the teacher will direct you as to where to dispose of all waste products as a result of the lab.
6. When you have completed your tests on all four powders raise your hand and the teacher will give you your next assignment. (*Mystery Powder Chart* and *Mystery Powder Chart Directions*)

Lab Sheet 1-A
Substance A

Place a sample of Powder A on Reaction Lab Chart. Look through hand lens and describe texture and color of powder and record under *Observation*. Then make a prediction as to what you think will happen when each substance is added to the powder.

Observation: _____

Substance added	Prediction	Result
Water		
Vinegar		
Hydrogen Peroxide		
Cabbage Juice		
Iodine		

Lab Sheet 1-B
Substance B

Place a sample of Powder A on Reaction Lab Chart. Look through hand lens and describe texture and color of powder and record under *Observation*. Then make a prediction as to what you think will happen when each substance is added to the powder.

Observation: _____

Substance added	Prediction	Result
Water		
Vinegar		
Hydrogen Peroxide		
Cabbage Juice		
Iodine		

Lab Sheet 1-C
Substance C

Place a sample of Powder A on Reaction Lab Chart. Look through hand lens and describe texture and color of powder and record under *Observation*. Then make a prediction as to what you think will happen when each substance is added to the powder.

Observation: _____

Substance added	Prediction	Result
Water		
Vinegar		
Hydrogen Peroxide		
Cabbage Juice		
Iodine		

Lab Sheet 1-D
Substance D

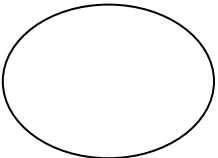
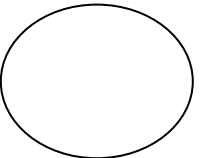
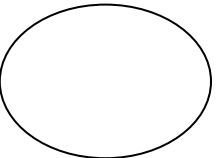
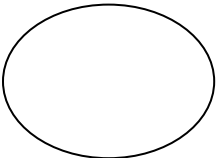
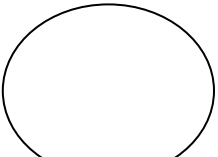
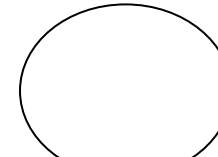
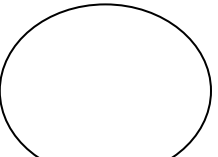
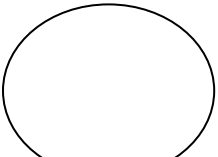
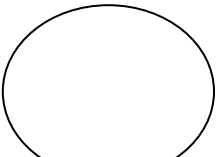
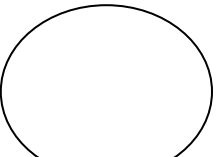
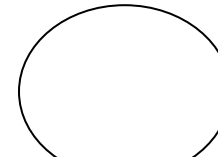
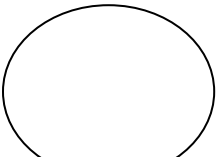
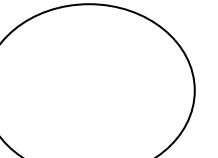
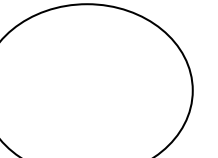
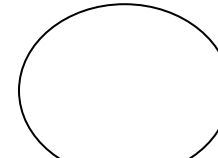
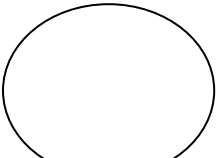
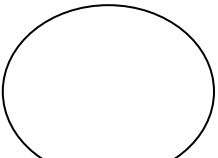
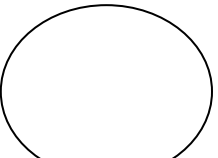
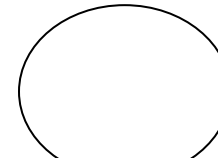
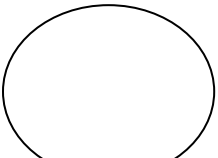
Place a sample of Powder A on Reaction Lab Chart. Look through hand lens and describe texture and color of powder and record under *Observation*. Then make a prediction as to what you think will happen when each substance is added to the powder.

Observation: _____

Substance added	Prediction	Result
Water		
Vinegar		
Hydrogen Peroxide		
Cabbage Juice		
Iodine		

Reaction Lab Chart

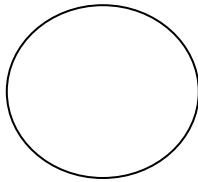
Directions: Test one row at a time. When finishing a row, wipe off to the left the test materials into a designated waste bin. Do not contaminate the remaining unused rows.

Powder A	Powder B	Powder C	Powder D
 Water	 Water	 Water	 Water
 Vinegar	 Vinegar	 Vinegar	 Vinegar
 Hydrogen Peroxide	 Hydrogen Peroxide	 Hydrogen Peroxide	 Hydrogen Peroxide
 Cabbage Juice	 Cabbage Juice	 Cabbage Juice	 Cabbage Juice
 Iodine	 Iodine	 Iodine	 Iodine

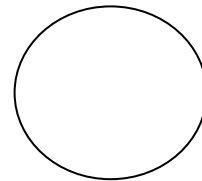
Mystery Powder Identification Chart

Directions: You will be given a mystery powder to identify. It will be one of the powders you tested from either vial, A, B, C or D. Use the same procedure you used to test the powders originally. When you finish with your tests you should be able to tell if the mystery powder came from vial A, B, C or D.

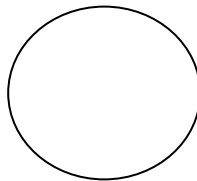
Observation (Look through hand lens and describe texture and color of powder.)



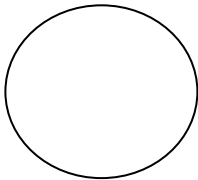
Water



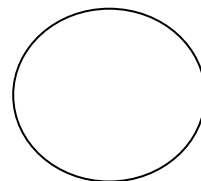
Cabbage
Juice



Hydrogen
Peroxide



Vinegar



Iodine

Newspaper Article Directions

After the completion of your test you then find out the following:

1. A body was found earlier this same day with traces of a mysterious white powder on its hands, arms, face and clothing.
2. Jon or Jane Doe was taken into custody after he was found in the area of the crime scene with visible traces of a white powder on his hands and clothing.
3. The powder found on John or Jane Doe turned out to be same powder as found on the body. It is the same powder you just identified as coming from vial A.

You will now assume the role of an investigative news reporter. Your article will be published in tomorrow's edition of your local newspaper. You must furnish the following detail in order to publish a complete article:

1. Who is involved?
2. What is the situation?
3. When did it happen?
4. Where did it happen?
5. Why did it happen?
6. How did it happen?

You will have 2 days to complete your article.

Website Investigation Worksheet

1. Go to **Google**. Type in Leonardo:Interactive Virtual Science Museum. You will access and explore two websites.
2. Click on #82 “Moving Man Project”. Look at the website and read through the general directions. You will be graphing the movement of the stick man.
3. Click on the stick man and drag him over to 5 meters. Watch what happens to the graph. (Note: If graph does not show scale in enough contrast, click on the *Rescale* button.
4. As the man goes toward the High School, what does the graph look like? _____

5. As the man goes toward the house what does the graph look like? ? _____

6. If the man moves slowly toward the house what does the graph look like? ? _____

7. If the man moves faster toward the house what does the graph look like? _____

8. What happens when the man comes to a stop along the line? _____

9. Continue to investigate this site by clicking on the house, school and different graphs.
10. When you get to this point, raise your hand and your teacher will clear you to go to step 11.
11. Now click on #183 “SpiroGraph”. Read through the general directions at this site. As this site, you will manipulate the buttons on the right hand side of the screen, one at a time, to create a SpiroGraph. When you have completed a graph, raise your hand and your teacher will check you off.
12. If time allow, your teacher will allow you to investigate the following websites on your own:
 - 181 Kaleidoscopes
 - 40 Symmetry
 - 12 Pendulum
 - 139 Moon Phases

Website Investigation Worksheet

KEY

1. Go to **Google**. Type in Leonardo:Interactive Virtual Science Museum. You will access and explore two websites.
2. Click on #82 “Moving Man Project”. Look at the website and read through the general directions. You will be graphing the movement of the stick man.
3. Click on the stick man and drag him over to 5 meters. Watch what happens to the graph. (Note: If graph does not show scale in enough contrast, click on the *Rescale* button.
4. As the man goes toward the High School, what does the graph look like? [The line is above zero (0). Zero is the starting point.]
5. As the man goes toward the house what does the graph look like? (The line is below 0.)
6. If the man moves slowly toward the house what does the graph look like? (The line is above zero but very close to the x-axis. The man is traveling at a very low speed.)
7. If the man moves faster toward the house what does the graph look like? (The line is above zero, starting point, with large peaks. The man is traveling at a very high speed.)
8. What happens when the man comes to a stop along the line? (The Line rest on the zero. No time is passing when he is standing still.)
9. Continue to investigate this site by clicking on the house, school and different graphs.
10. When you get to this point, raise your hand and your teacher will clear you to go to step 11.
11. Now click on #183 “SpiroGraph”. Read through the general directions at this site. As this site, you will manipulate the buttons on the right hand side of the screen, one at a time, to create a SpiroGraph. When you have completed a graph, raise your hand and your teacher will check you off.
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