Citiology
An Everyday Science Curriculum

by Barbara C. Kengor

Index:

Overview

Citiology is a unit designed to teach the science of our city. The curriculum has a wide scope and is discovery-based. The overall aim of the curriculum is to take science out of the classroom and to allow students to discover the laws and theories of science that apply to everyday life in Pittsburgh. The general theme of the curriculum will deal with questions such as:

What advantages are there to living in a city such as Pittsburgh?

How does science play a part in city living?

Are most people aware of the science that is evident in everyday happenings in Pittsburgh?

Who uses science in their work?

How can students spread the word about science?

Rationale

Citiology was designed to make science relevant to young learners. The content of this unit includes the major branches of science: biology, chemistry, physics and ecology. The process skills include the scientific method and the design process. The initial activities of the unit introduce the scientific method which will be used in each activity. Specific topics to be studied are fire prevention, forensic science, water systems, transportation, communications, housing, health care, recreation, greenspace, and employment. The curriculum is designed for third and fourth grade students in the gifted program. The activities are designed to enrich the science program taught in the mainstream schools. The science standards are the guideline for the content and process skills.

Objectives

The behavioral objectives of the curriculum are:

The student will be able to recognize the links between science in the classroom and the outside world.

The student will be able to increase her/his knowledge of the basic principles of physics, chemistry, biology and earth science.

The student will be able to complete hands-on experiments using the steps of the scientific method.

The student will be able to transfer information from science class to home, in order to complete assignments

Strategies

The teaching strategies for this curriculum are to allow each student to make his/her own discoveries about the material being studied. The scientific method will be introduced early on and used throughout the activities. Hands-on activities will be part of each topic. Extension activities will be suggested as a way of linking school and home. A culminating project will pull together learning in a practical way. The course is designed to be taught over the period of one school year, to third and fourth grade science students. The material is organized to be used in a one day, pull-out program for gifted students.

Activities

Citiology starts in school. Explain to students that in order to study our city we must have a process and a starting point. Our process is the scientific method and our starting point is our school.

Introduction

Read the book *Math Curse* to the class and discuss it. The book explains how math is everywhere. The book is written in the first person and describes how everyday tasks can be seen as math problems. There are delightful illustrations in the book and it gets a point across in a humorous way. The math teacher is Mrs. Fibonacci and the science teacher is Mr.

Newton. Ask the students if they might feel the same way about science being everywhere. Have students give examples of science in everyday life.

School tour

Give each student a clip board and pencil. Explain that the first step in the scientific method is choosing a problem. A problem can be something that you have always wondered about, something that is interesting to you or something that you might like to change. Take students on a tour of the school building and have them jot down "problems" that they see. Use sentence starters if they need help such as:

I wonder why…….

What if…….

How does……

Where does…..

Compile a list on a poster in the room and refer to it as you complete the city science unit.

Some of the items listed by the students are likely to be covered as a natural part of the unit. Other items could be assigned as independent research or used as a science fair project.

Research

The second step in the scientific method is research. In this curriculum research will be in the format of keywords. The keywords will help the student to understand basic concepts before experimenting. This will make the procedure more meaningful. Have students help to develop a rubric for keyword research. Throughout the activities terms that might be used as keywords will be highlighted.

Hypothesis

In this curriculum a ***hypothesis*** will be written as an *If…then* statement. Read the book *IF* to class and have them use their imagination to create an *If* statement and picture based on the book. Explain to the students that while an *If* statement could be boundless, a hypothesis (an*IF…then* statement) must be based on research.

Procedure

The steps used in an experiment are called the procedure. In order to have students realize the importance of correctly following experimental procedures have them complete a simple experiment on school lunch treats. Explain to the students that they must try to make their school lunch treat last as long as possible in their mouth. Give each student a 3-pack of *Sweet Tarts*. Formulate a problem question with the class. (Example: How can you make your candy last longer in your mouth?) Discuss what research would be needed for this experiment.(Read the package ingredients) Determine keywords.(saliva, sugar) Explain that in an experiment something must remain the same. It is your ***control.***

The thing you are testing changes. It is your ***variable***. In this experiment the control is the candy. Each piece of candy is the same. The variable is what you do with the candy when you put it in your mouth. Collaborate with the class as you determine the experiment steps. Suggested steps might be 1) place a candy on your tongue, keep your tongue still and record the time it takes for the candy to dissolve, 2) place a candy on your tongue and move your tongue around in your mouth and record the time it takes for the candy to dissolve, 3) place a candy on your tongue and move your tongue and teeth over the candy and record the time it takes for the candy to dissolve.. Have students design a chart or table in which to record the results. (*adapted from Tasty Solutions/The Science Spot)*

Data Collection

The results of an experiment are called data. Tell students that they cannot write in sentence form when they record data. Let them pair up and design a table, chart, sketch or graph that explains the results.

Analysis and Conclusion:

Have student pairs exchange their data collection results. Using another pair's results have students write a statement about the findings. Discuss what happened in the experiment and how to record and analyze their information.

The City Fire Department.

The Bureau of Fire in the city is concerned with fire prevention, fire suppression, emergency response, dangerous materials, arson investigation and education . To make students more aware of the services of the fire department this section will take a scientific look at fire.

What is fire?

Have students build a 3-D model of the fire *tetrahedron*. (an update of the fire triangle)

Color each panel a different color and label it with the elements of fire. A fire needs fuel, heat, air, and combustion. Review and discuss the meaning of each element. ***Fuel*** is the material that burns in a fire. Fuel can start as a solid, liquid or a gas but all fuel turns to vapor as a fire burns. Materials high in carbon and oxygen are the best burners. Wood and paper are good fuels. ***Heat*** is actually the movement of molecules in a substance. The faster the molecules move the hotter the substance gets. Heat can start by chemical reactions, friction or electric activity. ***Air*** refers to the oxygen in the air around us. ***Combustion*** is the chain reaction that starts and keeps a fire going. (adapted from *The Anatomy of Fire*)

The Burning Candle

Light several candles for the students to observe. Let the candles burn for about 10 minutes while students watch them and record their observations by answering the following questions: What are the colors in the flame? What is the color of the wick? What happens to the wax as the candle burns? What happens to the wick? What is the fuel? What is the heat source? What was the combustion reaction? (adapted from *Chemical History of a Candle*)

Space candles

Have students visit the NASA KIDS website and read the article, *A New Flame*

(*http://kids.msfc.nasa.gov/News/2000/News-Flames.asp*). Discuss the shape of a candle flame. The reason for the shape is ***gravity.*** Have students set up candles to demonstrate a flame in ***microgravity***. Use 2 birthday candles. Stick a mound of clay onto the table, use a thick wire to create a candle holder. Bend one holder so that the candle burns normally with the wick on top. Bend the other holder so that the wick is on a downward angle. Have students predict how each flame will look. Compare the results with the information found on the NASA website.

Fire Safety

Have students visit *www.kiddesafety.com* and take the Home Safety Checklist for their age group. Review and discuss the results.

Introduce E.D.I.T.H. (Exit Drill in the Home) to the students by discussing what to do when a fire starts. If you hear the smoke alarm while you are sleeping you should roll out of bed, crawl to the door and check the door by feeling it. If it is hot DO NOT OPEN THE DOOR, crawl to your window, open it and call for help. If the door is cold, open it SLOWLY and continue crawling out of the house. Meet your family outside and call 911. Conduct a practice fire drill for the classroom using several scenarios.

The classroom door is closed and feels hot.

The hallway is filled with smoke.

The exit to the hallway is locked and blocked.

Candle Flame Fire Extinguisher

Have the students build model fire extinguisher. Use a 20ounce plastic soda pop bottle.

Remove the cap and drill a hole in it that is big enough for a straw to fit through. Push the straw into the hole and set the cap aside. Put 3 tablespoons of vinegar into the bottle and set it aside. Lay a tissue out flat and place 1 tablespoon of baking soda in the middle of it and tie the edges together with thread. Carefully push the tissue into the bottle while holding onto the thread. DO NOT LET THE TISSUE TOUCH THE VINEGAR. Put the cap on the bottle. This will hold the thread in place. Have the students write directions for use and tape them on their fire extinguishers.

To use: Tip the bottle so that the tissue gets wet with vinegar. Point the straw toward a burning candle to put out the flame.

Light candles in the room and have students use their fire extinguishers to put out the flames. Discuss the **chemical reaction** that took place in the bottle. The vinegar mixed with the baking soda to form carbon dioxide gas, the same gas that is used in a real fire extinguishers. When the carbon dioxide gas was aimed at the flame, it took away the oxygen that the fire needed to keep burning. (adapted from *Chemistry Experiments*, *Carbon Dioxide Projects*.)

The Bureau of Police

The investigations branch of the Pittsburgh Police investigates and solves crimes against persons and property. This section of the Citiology unit will deal with the part that science plays in investigating and solving crimes.

Fingerprinting

One way that police use to solve crimes is the collection of fingerprints as evidence. Since each person has a unique fingerprint, no two in the world are alike, police can compare fingerprints found at a crime scene with those of the crime suspects to find the guilty person. Have students take their own fingerprints. Each student should use a pencil to color a small piece of paper completely by rubbing. Then they should press their thumb onto the pencil rubbing and coat it. Using a small piece of transparent tape the student should lift the fingerprint from the thumb and tape it onto a hand outline.

Repeat the procedure for each finger. When finished have the students study their fingerprints. Ask students to compare their prints to at least two others in the class. Discuss the differences and similarities in the prints. Investigators that use fingerprints to solve crimes must be well-trained and experienced to see the differences in fingerprints.

Classifying Fingerprints

There are three categories of fingerprints: ***loop, arch*** and ***whorl***. Have the students look at examples of the three print types and decide what type of fingerprint category their prints fit into. Remember that each finger may be a different type of print and that each print is different from person to person. Make a chart of the class fingerprints to see which is the most common type of print found in the class. (GEMS,*Mystery Festival*)

Footprints

Crime scene investigators also look for footprints in order to catch a criminal. Have the students divide into two groups: Criminals and Investigators. Give the criminal group a cookie sheet with soft soil pressed into it. Have one of the "criminals" take off their shoe and press it into the soil being sure to keep their identity secret from the investigators.

Make sure that the shoe is then cleaned off and replaced on the criminal's foot.

While this is being done have the investigators prepare their materials. They will need hairspray and a thick mixture of Plaster of Paris.

Call in the investigators and have them study the footprint and the shoes of criminals. The investigators can make an educated guess as to the guilty person. In order to have real evidence the investigators should then spray the soil print with hairspray. When the hair spray dries pour the Plaster of Paris into the footprint and let it set. When the mixture hardens remove it from the soil, clean it off and compare it with the bottoms of the criminals' shoes. Does this evidence point to the same suspect? Discuss how important the collection of evidence is for police. (adapted from *Newton's Apple, Murder Mystery*)

Cloth Fibers

Many times criminals leave traces of their clothing behind when they flee a crime scene.

Investigators study cloth fibers to see if they match the clothing worn by a suspect. Give each student a 4 inch swatch of material (cut with no hem). Instruct students to observe and describe the cloth's ***physical properties***. These properties include color, texture, arrangement of fibers, patterns, and weight. Have students draw the cloth as they see it. Then have the students pull a thread from the edge of the material and observe it using a hand lens or a microscope. Have students describe and draw what they see. Talk about the fact that many times an investigator has only a thread to look at when building a case against a suspect. Collect a thread from each student and place it in a covered petri dish and mark it with a sticker on the bottom of the dish so that the student's initials are on the dish but cannot be seen by some one looking into the top of the dish. Mix up the dishes of threads and the swatches of material. Have students try to match the thread to cloth that it came from. Check the accuracy of the students by checking the initials on the dishes. (adapted from *Forensic Science Project, Physical Evidence*)

Stains

When police go to a crime scene they may find stains or marks at the scene which could provide clues as to the identity of the subject. Have the students check stains by using their ***senses*** to determine what the stain is. Prepare pieces of white cloth by staining each piece with a different substance. Some substances might be perfume, ketchup, juice, oil, or vinegar. Pass out several stained cloths to small groups of investigative teams of students.

Give the students time to study the samples and write down what they think that the stain is. Student groups should check their answers with the teacher and keep working until all the stains are identified correctly. Have the student groups use the stains to write a short story or skit about what crime might have been committed and how the stains were a part of it. Present the stories or skits to the class.(*adapted from Forensic Science, Physical Evidence*)

Hair Analysis

If investigators find a strand of hair at a crime scene they collect it to observe it under a microscope. Have students obtain 3 hair samples, one from their own head and two from friends. Students can bring in animal hair samples also. Use the hairs to make a wet mount slide by placing the hair on a clear slide and adding a few drops of water on top of the hair. Place a clear cover slide over it. Have the students observe the hair under a microscope and record its characteristics. Look for color, thickness, texture, split ends.

If animal hairs are available ask students to try to determine any differences between animal hair and human hair. Ask why this might be an important piece of evidence at a crime scene. (adapted from *Forensic Science, Physical Evidence*)

Water and Sewer Authority

Pittsburgh's water and sewage management has been provided by the PWSA for over 200 years. Water quality reports are available to the public and describe the how and with what chemicals our drinking water is treated. Water is important to everyday life. The average person uses 160 gallons of water each day. This section of Citiology will deal with where our water supply comes from, how it is prepared for use and how we use and sometimes misuse this precious resource. (PWSA website)

Raw Water

Explain to the class that in order for a city to have water for its residents there must be a natural supply of water somewhere near the city. This is called ***raw water***. Have the class view the video "The Mon,the Al and the O". This video describes the rivers of Pittsburgh and explains how Pittsburghers use these rivers.

Reservoirs

Have students make a KWL chart about reservoirs. Write down what the class already knows, what they want to know and at the end of the activity fill in what they learned.

A ***reservoir*** is a place to hold water and it is the part of a water system known as storage.

The city of Pittsburgh has several reservoirs. The closest is a covered reservoir next door to McKelvy school and the best known is the Highland Park Reservoir which is the only uncovered reservoir in the city. The water stored in the city reservoirs has already been treated and is waiting to be used by residents of the city and nearby towns. The reservoirs are located on high ground and gravity is used to help move the water. Have the students research the city reservoirs using the internet. Search words might include: Pittsburgh, reservoir, Herron Hill, Highland Park, Quarry Hill, Bedford Avenue, Brilliant Hill, Lanpher, McNaugher, Brashear. Students may present their findings and the teacher could discuss the history of the city water system. Information is available online at several sites. (PWSA Website)

Treatment Plants

Treatment plants purify water so that city residents can drink it. The water in the treatment plant is held in big containers so that dirt particles settle to the bottom. Then it is moved to another container where it gets stirred up and settled again. Then the water flows through a filtering system of sand, charcoal and gravel. Chemicals are added to kill germs and fortify the drinking water. Have the students replicate this process by filling a jar with water to which some soil has been added. Shake the jar and allow it to sit for 20 minutes. Have students make observations about the water in the jar before shaking, after shaking and after sitting. Pour the water from the first jar into a second jar. Try not to get the settled particles from the bottom of jar #1 into jar #2. Shake jar #2 and allow it to sit for 20 minutes. Make the same observations as were done with the first jar. Lastly have the students pour the water from jar #2 through a coffee filter and make observations about the water and the particles on the filter. Ask students to think about what chemicals they might now add to the water to kill any germs. Use this “purified” water for the plants in the school. (adapted from *Just Add Water*)

Water Usage

The average person uses 160 gallons of water each day. Show students a gallon container so that they can picture what 160 might look like. Ask students to keep a water diary for 24 hours. When students return their diaries talk about ways to reduce water use at home. Have students brainstorm sayings that could be posted on cabinets, refrigerators or in bathrooms that would remind family members to conserve water.

The Water Cycle

The water cycle provides raw water for our use. ***Precipitation*** is water that falls to earth in the form of rain or snow. This water fills the oceans and runs off the land to form rivers, lakes and streams. This is called runoff. Some water soaks into the ground and becomes groundwater. As the sun heats up the surface of the earth it also dries up, or evaporates, the water that has fallen to earth. Some water that was absorbed by plants comes out of their leaves in a vapor form and adds moisture to the air. This is called ***transpiration.*** Because these water vapors are warmer than air they rise into the sky. They collect in the clouds and when the vapors cool they return to their liquid state. The result is rain or snow. The water cycle goes around and around like a bicycle wheel.

Have students watch a demonstration of the water cycle using a water cycle model kit.

Hubbard Scientific makes a plastic model that uses ice cubes and a lamp to illustrate the water cycle.

Transportation

In order for people in the city to travel from place to place city planners design roads, bridges and tunnels. Civil engineers study the land and the travel patterns of city residents to determine how best to build a transportation system in a city. These engineers must develop materials to cover roads that will keep them smooth and hard. Bridges must be strong and tunnels must be able to support the weight resting on them.

Because of the geography of Pittsburgh inclines were also developed to help people travel around the city.

Asphalt Cookies

Bring in several pieces of asphalt from city roads. Small pieces can be found near potholes or work areas and are easy to collect. Have students observe the pieces and describe them. Explain that asphalt is manufactured in a plant. When asphalt is heated it turns from a solid to a sticky liquid. As it cools asphalt hardens. Prepare a batch of "asphalt" and pour it into a crock pot. Have the students observe the mixture and compare it to the real asphalt pieces. What is missing? Explain that small rocks are added to asphalt to make it stronger. Add ingredients to the "asphalt" to replicate small rocks. (coconut, chopped nuts, dry oatmeal, mini candies). Give each student a paper cup and a spoonful of the warm asphalt mixture. Have the students stir the mixture and note that it becomes stiff as it cools. This is the same thing that happens to real asphalt as it is mixed. Pass out two pieces of wax paper to each student and have them scrape their asphalt mixture on to one piece, cover it with the other piece of wax paper and press them together. In real life the asphalt is spread over the street and rolled with a heavy roller. Have students roll their asphalt with a can. Have students feel the top of the asphalt cookie for warmth. Just like real asphalt it will feel warm as it spreads. Just like real asphalt it will harder as it cools. When the asphalt cookies cool compare them to the real samples of asphalt. (SWE Civil Engineering Website)

Recipe for Asphalt Cookies

Mix the following ingredients in a saucepan and heat, stirring frequently. Boil for 2 minutes. Pour the mixture into a crock pot to keep warm and liquid.

2/3 Cups of Cocoa Powder

1 Cup Milk

1 Stick Butter

3 Cups Sugar

To complete the asphalt use chopped nuts, coconut flakes, mini candies, or oats

Tunnels

Pittsburgh has many tunnels that provide a means of transportation to get from one side of the city to the other. Many years ago tunnels were dug in order to mine coal but are now dug through hillsides to keep traffic moving. Have students visit the *Building Big* website*(www.pbs./wgbh/buildingbig/tunnels)* This website gives students an opportunity to take the *Tunnel Challenge*. Have students follow the directions for the activity. After the computer session ask students to define ***aqueduct, bore, vault*** and ***excavation.***

Bridges

Due to the three rivers of Pittsburgh, the Monagehela, the Allegheny and the Ohio, our city has more bridges than any other. There are three main categories of bridges: ***beam***, ***suspension*** and ***arch.*** Have students do research to find an example of each bridge type.

There are books that can be used. Two of which are of *Engineers Dreams: Great Bridge Builders and the Spanning of America* (Henry Petroski, Knopf,1996) and *Bridges: A History of the World's Most Famous and Important* (Judith Dupre, Black Dog and Levanthal Press,1993.)

Bridge Building Contest

Have students divide up into teams for the task of constructing a straw bridge that will hold the most weight. Student teams will be given 30 plastic/bendable straws, 1 roll of masking tape, 6 textbooks, scissors, paper, and pencils. The task is to build a bridge that will span six inches and hold the most weight. Using the textbooks piled three on each side of a table, measure six inches between the piles. Explain to the students that bridges are structures that carry city residents across natural or man-made obstacles. Some of the obstacles in Pittsburgh are rivers, railroads, parkways and streets. City engineers must look at the span to be crossed and who or what will cross the span. Instruct student teams to plan a bridge to hold as much weight as possible. Develop a time frame for bridge completion with the class. Give them the allotted time agreed upon and then test the bridge by putting a small plastic cup on the bridge and then adding pennies until the bridge can no longer hold the weight. Have the students discuss the success or failure of their bridge and what design makes one bridge stronger than another. (adapted from SWE, Civil Engineering Website)

Inclines

In the late 1800's Pittsburgh had 16 operating inclines carrying people up and down the hillsides of their neighborhoods. The credit for designing this mode of transportation goes to three men and one woman. These four engineers changed the way people traveled in the city. Today only two inclines are still in use in Pittsburgh. The designers of the inclines utilized the concepts of two simple machines in their work: the inclined plane and the pulley. (Bridges and Tunnels of Allegheny County Website)

Inclined Plane

Machines are devices that make work easier. An ***inclined plane*** is a simple machine that makes it easier to move an object to a certain height. Have students complete an experiment to illustrate this concept. Use a stack of books that reaches 8 inches in height.

Make two ramps from strips of corrugated cardboard or foam board. One ramp should be 12 inches in length and the other should be 36 inches Run the ramps from the tabletop to the top of the book stack. Give each student a small toy car with a front bumper. Have the student fasten a rubber band on the bumper of the car. Place the car at the bottom of the short ramp and pull on the rubber band to move the car up the ramp. Note how far the rubber band had to stretch before the car moved. Try this again on the longer ramp. The rubber band stretches less on the longer ramp than it did on the shorter ramp because a long slope requires less effort than a short steep slope. Based on this experiment have students discuss why engineers build long winding roads on a steep hillside rather than short steep ones. Ask students to think of any long winding roads they have been on in Pittsburgh and to discuss why the incline designers might have wanted a better way to travel up and down the hills of Pittsburgh. (adapted from *Physics for Every Kid*)

Pulleys

A ***pulley*** is a wheel with a rope or cable running over it. The cable is held in position by a track or groove cut into the wheel. Simple pulleys can be seen all over the city. Flag poles use a pulley to raise and lower the flag. Construction workers use pulleys to lift heavy loads to the top of a work site. Elevators use a pulley system to move from floor to floor. The incline cars have cables connected to wheels plus a large engine at the top of the incline to power the cars. Use a broom stick handle lined up across two chairs or tables. Fill a bucket with water and allow each student to lift it and note how heavy it is. Tie a rope onto the bucket's handle and run the rope over the broomstick. Have each student pull on the rope to lift the bucket. Ask the students which way was the easier way to lift up the bucket.

Setting up this simple machine provided a mechanical advantage to make it easier to raise the bucket. Ask students to look for examples of pulleys in their homes and bring back a list to share with the class.(*adapted from Be A Kid Physicist*)

Communications

The transfer of information among city residents is important. People want to know about the weather, upcoming events, world happenings and each other. Communication systems provide this service and this section of Citiology will deal with several facets of communication.

Television

Pittsburgh has a direct link to the birth of television in that Vladimir Zworykin, nicknamed the "Father of Modern Television", did his work on the picture tube at Westinghouse Electric. Also, the beginnings of cable television took place in the hilly areas outside of Pittsburgh to improve channel reception. No one person actually can claim that he/she was the sole inventor of television because many scientists were working on the idea and its parts around the same time. Philo Farnsworth transmitted a TV image in 1927. Zworykin demonstrated how a TV would work in 1929. Work on the invention continued and it was in 1939 that television was showcased as a workable invention at the World's Fair. Since that time the use of television has expanded to a remarkable degree. At the time of his death Vladimir Zworykin was not pleased that his invention had become so widely used. He wanted it to be used to promote education and the arts and to be viewed sparingly. A television has two components: audio and visual. Have students explore these two concepts. (Inventors Online Museum)

Audio

Sound travels in waves. Use a slinky to demonstrate how sound travels. Have students pair up and stretch out a slinky between them leaving a little slack within the coils. Direct one student to compress two or three coils at one end of the slinky, then release them. Observe the reaction. (The motion travels the length of the slinky and causes the entire slinky to vibrate). Lay the slinky across a table and repeat the same movement. Ask students to listen for any sound as the slinky vibrates on the table. This is called a ***compression wave*** and if we could see sound it would look like the moving slinky. (adapted from *Physics for Every Kid*)

Video

Video refers to the image that we see on a television screen. Some images you see on a television or movie screen are animated. Animation is moving pictures fast enough that your brain is fooled into thinking that you are seeing action. Thaumatropes are toys from the 1800's that demonstrate this concept. Have students make their own thaumatropes.

Use a 5x7 index card. Cut it in half. On one half draw an animal. On the other half of the card draw something related to that animal such as a cage, tank, pond, or dog house.

Tape the halves together on three sides so that the pictures are showing. Slip the taped card onto a round pencil and secure it with staples or more tape. Have students spin the pencil in their hands and observe the pictures. The drawings will combine. ***Thaumatropes, zoetropes, kinetropes*** and ***stereoscopes*** were all forerunners of television and movies. Have students research these inventions. (PBS Kids Zoom do Website)

Telephone

The credit for inventing the telephone goes to Alexander Graham Bell. Since the invention of the first telephone there have been many changes but the basic science has remained the same. Vibration is still what is needed to hear and be heard when using a telephone. A signal is sent through a cable thousands of miles out into space and back to a phone. That signal shakes a plastic disc in the ear piece to make sound. Have students make a basic string phone using two cups. Provide students with cups of various sizes and made of different substances. (plastic, styrofoam, tin can). Provide students with string, thin and thick wire, yarn and plastic twine. Have students make predictions about which materials will make the best "telephone". Have the students build the telephones and test them. (Adapted from *What Happens When…?*)

Computers

The computer age has changed the way people communicate and the way that people learn. The internet has provided us with information on every topic we can think of to research. Use the internet site : *www.girltech.com* to read about new inventions that could change the future. Have students discuss the inventions and their uses when they are finished exploring the Girl Tech website.

Housing

City residents live in all types of houses made of many various materials. In this section of citiology the students will learn about the facets of building and maintaining the living spaces in our city. Experiments and activities will involve electricity, nonrenewable resources and renewable resources.

Plug In

Ask students to think about where the electrical power in their houses comes from. This power is an example of energy transformation. ***Electricity*** is made or generated by burning coal, oil or natural gas; from a nuclear reactor; from the sun, wind or water. The process begins as the fuel is turned into heat energy and steam is produced. The steam turns the turbine, which creates ***kinetic energy***. The generator spins coils of wire in a magnetic field. The kinetic energy is changed to electrical energy. The electrical energy travels to houses through wires. It is then changed from electrical energy to heat energy or kinetic energy. Have students design their own original diagram to show how electricity is formed and used in their homes. Label heat energy, kinetic energy and electric energy.

(*The Visual Dictionary of Physics)*

Nonrenewable Energy

Much of the energy used in our homes today is nonrenewable. That means that it is a resource that cannot be made in a short amount of time. Coal is a ***nonrenewable resource*** that comes from what is left of plants that lived millions of years ago. Natural gas, propane and petroleum come from ancient plants and tiny sea animals that were put under great amounts of heat and pressure. These resources are called fossil fuels because they originated from plant and animal remains. Nuclear energy that comes from uranium as its source is also nonrenewable. Coal is a nonrenewable resource that will be looked at more closely in this section. The best coal to burn is clean or pure coal because coal can sometimes contain pyrite or fool’s gold. When coal with pyrite is burned the pyrite gives off sulfur dioxide, which can cause acid rain. Have students participate in a demonstration on how mineral matter may be separated in coal. Use two small glass jars. Put water in one and salt water in the other. Use a 4 to 1 mixture of water to salt. Add a drop of liquid soap to each jar to break the surface tension. Into each jar place 1 teaspoon of finely ground coal.

The coal can be prepared by crushing pieces with a hammer. Shake the jars to mix up the ingredients. Allow them to sit for 10 minutes and observe. Allow them to sit overnight and observe them once more. The heavier particles will settle on the bottom. These particles are the minerals in the coal and they are more dense than the salt water. The floating particles are the clean coal and they will float. Compare the two jars. Observe what happened in the jar with plain water. Discuss the results with the class and ask students why scientists would want to learn how to separate coal from its minerals. Have students relate this process to the cleaning and purifying of water that they learned about earlier in the unit. (adapted from *Hands-on Earth Science Activities*)

Renewable Energy Sources

Scientists are working on using alternative sources of energy that can be renewed in a shorter period of time than fossil fuels. Solar energy is one of the most widely known. Have students think about the possibility of the sun as a source of energy for our city. How would energy from the sun be collected and stored. Have students look for information about a ***solar*** collector and a solar hot box. While they are basically the same, the difference between the two is that a solar collector transfers the heat energy it collects to another location, but the solar hot box stores the collected energy for later use. Have the students divide into groups to design a solar hot box. Provide these materials: shoe boxes, colored cellophane, tin foil, scissors, tape, construction paper and thermometers. Using the information that they found as they researched and the materials provided instruct each group to build a box to collect the sun's heat and place a thermometer inside Take the boxes outside in the sunlight. Have the students check the temperature on the thermometer each minute for 10 minutes. Compare the temperatures reached among the various boxes. Compare and contrast the box designs to determine which worked the best and why. (*Solar Hot Box*, John Sandru)

Health Care

All cities have places for residents to receive medical care. In Pittsburgh we are lucky to have a large number of hospitals and centers to help sick people get better and healthy people stay well. In this section of the Citiology unit students will learn about several health issues that are being dealt with by the Pittsburgh medical community.

Healthy Hearts for Kids

Healthy Hearts for Kids is an internet module that will teach students about how the heart works and how to stay healthy. This program requires that the school and teacher register online. A user name and password is assigned to the teacher and materials are provided. It is suggested that this module be used in a computer lab once or twice a week. In this unit it will be used as a supplement to the section about health services in the city. The website is *www.healthyhearts4kids.org.*

Heartbeats

The medical and research centers in Pittsburgh are well known for their work with heart disease, heart disease prevention and heart transplant. Have students become more familiar with healthy habits by using science and math skills to learn more about the heart. The heart is a ***muscle*** about the size of the human fist. Have students make a fist and note the size. Have them observe the veins in the wrist and explain that the human heart is like a pump that moves blood through the body. The harder a person works the more pumping the heart has to do. When resting, about 5 liters of blood flow through the heart per minute. When exercising, the flow increases to about 20 liters. This is because of the need for more ***oxygen*** in the body as it is moving quickly. This pumping can be felt at certain points on the body and it is called a ***pulse.*** There are two places on the body where the pulse can easily be felt, the inner wrist at the base of the thumb (***radial artery***) and just beneath the jaw near the ear. (***carotid artery***) Have student find their pulse by placing the index and middle fingers of the right hand on their left wrist or under their jaw. Use a clock with a second hand or a stopwatch and allow the students time to count how many pulse beats they feel in 15 seconds. Practice this a few times until everyone can get a number. Have students record the pulse and multiply it by 4. This is the number of heartbeats per minute at rest, the resting heart rate. Have the students engage in a physical activity for several minutes and then take their pulse for 15 seconds, multiply it by 4 and record the number. This is the active heart rate. Have the class list the ordered pairs on a large sheet of paper. The first number is the beats per minute before exercise. The second number is the beats per minute after exercise. Ask the students what the data shows. Use a large piece of graph paper to plot the ordered pairs on an x-axis and a y-axis. Allow students to make predictions about what the graph will look like and what the data represents. (adapted from *Healthy Hearts and Bodies*and *Heartbeats* Lesson Plans)

Smoking

Many years ago Pittsburgh was called the "Smoky City" due to the air pollution created by the steel mills and factories in the area. Today, city air is sometimes polluted by people who smoke cigarettes. Have students review the health dangers of smoking. Make sure to discuss lung problems, increased risk of heart disease and other problems such as bad breath, reduced sense of smell, tooth and gum disease, chronic coughing, shortness of breath, headaches, stress. Use the ***Smoky Sue Doll*** to illustrate what smoking does to a person's lungs. The doll is actually a squeezable bottle that simulates the actions of the lungs. The lining of the lungs should be pink and clean. When a clean, white tissue is placed as a filter within the doll and a lighted cigarette is placed in the doll's mouth, the doll's body is squeezed. As ***Smoky Sue***"smokes" the cigarette the tissue will become stained with residue, the same residue that would build up on a person's lungs. (*Note: Permission to use the doll should be obtained before this lesson. Parents and the principal should be informed of the lessons in the unit and what they will entail.)* Have the students watch the demonstration outside and then study the tissues when they reenter the classroom. Discuss the dangers that smoking presents to the lungs as students make observations about the tissues. (*National Center for Tobacco-Free Kids*

Recreation

The city of Pittsburgh Department of Parks and Recreation provides playgrounds and green spaces for city residents. There are over 200 places to play in our city. There are also privately owned and operated parks near the city for residents to visit and enjoy. This section of the curriculum looks at the science involved in using playground equipment and enjoying amusement park rides. (*A Guide to Pittsburgh's Great Parks*)

Swings

A swing is really a ***pendulum***. A pendulum is a fixed object attached on the end of a rope, chain or rod. A pendulum swings back and forth due to the weight of the object attached to its end. The time that is takes for a pendulum to swing back and forth once is called a ***period***. Take the students to a play area with swings if possible. If no play area is close by the students could use unwound yo-yos to simulate the pendulum action of the swings. Have the students brainstorm ideas about what makes a rider go high and fast on a swing. Have the students develop a hypothesis to test on the playground. Examples might be: *If there is more weight on the swing seat it will go faster or If the chain on the swing is longer it will go faster.* Have students list the ways that they might test their hypotheses and go to the play area or use the yo-yos to do so. (adapted from *Playground Physics)*

Slides

A playground slide is really an inclined plane with many variations. Have students discuss the different types of slides that are seen on city playgrounds. Two science concepts related to slides are gravity and ***friction.*** Have students research Sir Isaac Newton and the laws of gravity. With this information in hand have them try rolling balls of the same size but different weights down the slide. Use a baseball, a tennis ball and a whiffle ball. Have three students let go of the balls at the same time. Discuss the results. Now have the same students drop the balls on the ground at the same time. Ask students to discuss the relationship between weight and gravity. Friction is the force of resistance that occurs when two objects rub against each other. Some materials increase friction and others decrease friction. Ask students to observe their clothing and that of their classmates. Have students predict who will slide down the slide the quickest based on the type of clothing that they are wearing. Use a stopwatch to time class members as they slide down. Chart the results. Ask students how friction could be decreased on the slide. Have students choose from sheets of wax paper, plastic, cardboard or other materials to use to try to lessen the friction and speed up their descent on the slide. Try them out and record the results. Compare the results. (adapted from *Roller Coaster Science*)

Bumper Cars

Bumper cars operate on three scientific principles: ***inertia, impulse*** and ***momentum.***

Have students explain what they know about the bumper car ride at Kennywood or another amusement park. Have students focus on how they (their body) feel on the bumper car. Explain that when bumper cars collide and stop, the rider keeps moving inside the car. That is inertia. Impulse is the product of a force and the time interval over which it acts. When the cars hit into each other the impulse goes from one car to another. This gives the car momentum. Momentum has to do with the mass of an object (the bumper car) and the speed of the object. When one car bumps another some of the momentum is transferred making the cars move. For safety the cars have large rubber bumpers that slow down the transfer of momentum. Have students use toy cars and small pipe cleaner figures to illustrate inertia, impulse and momentum. Instruct students to make stick figure people from pipe cleaners to be riders. The pipe cleaner people can be loosely attached to the cars by their legs. Place the cars in a shallow box or pan. Have students gently and then with more force simulate the bumper car ride with the toy cars. Head on collisions are forbidden just as they are on the real ride. Have students make observations about what happens to the cars and riders as they collide using the keywords inertia, impulse and momentum.

Have students design bumpers for their cars using straws or rolled up paper and tape.

Have students observe any changes in the action when the cars have bumpers on them.

(adapted from *Roller Coaster Science*)

Roller Coasters

Rollers coasters operate on the scientific principles of gravity and the ***law of conservation of energy***. Gravity is the force of attraction between objects. The law of conservation of energy states that energy can be changed from one form to another but cannot be created or destroyed. Have students build a simple coaster using strips of corrugated cardboard. Cut the cardboard in 2 inch wide strips. Have students tape sections together and fold up the sides ½ inch. Explain that in a real roller coaster there is a motor on the track which pulls the cars to the top. The classroom coasters will use marbles as cars and will start the ride at the top. Using the tables, chairs, books or other classroom equipment allow students to set up the coaster tracks. They can create as many hills as desired but no hill can be higher than the first. Instruct students to place the marble on the highest point of their roller coaster and let it roll. Give students time to make adjustments to their tracks so that the marble completes the course. Give students markers and instruct them to mark G for gravity, P for potential energy and K for kinetic energy along the track at any place where they think that the phenomenon occurred. Allow each student to explain where she/he put the letters and why. Discuss the information in a wrap-up session with the class. Students may want to make more elaborate coasters with twists and loops. Let them research ***centripetal*** and ***centrifugal*** force. (adapted from *Roller Coaster Science*)

Fun House Mirrors

Mirrors work because of ***reflected light***. Light bounces off an object towards the mirror. If it is a flat mirror the light bounces back at the same angle that it bounced forward. (the law of reflected light) When the reflected light hits the lens in the human eye an image gets focused on the retina. ***Convex*** and ***concave*** mirrors are used in a fun house because they distort the image that a person sees. Give each student a strip of shiny silver bulletin board paper. (12inches by 3 inches) Have the students hold the paper straight and observe their image in the paper. Now have the students form a convex curve (bending out) and observe their image. Then try a concave curve (bending in). Discuss with the students why the images are distorted. In a curve mirror the reflected light get bounced back to the eye in unusual directions. The lens of the eye cannot focus. The brain tries to identify the image but creates a distorted or confused picture. Have groups of students use large pieces of bulletin board paper to make fun house mirrors using more than one curve. Have the class make predictions about what the images will look like based on the curves. (adapted from *Roller Coaster Science*)

Greenspaces

Today most cities in the United States are trying to restore and preserve the greenspace in urban areas. Pittsburgh is no exception. City groups are working in the parks and along the rivers to rehabilitate these areas. This section of the curriculum will look at Pittsburgh's four great parks and recreate some of the work being done in them.

Bioblitz

Highland Park was the site of this year's bioblitz. A bioblitz is a 24 hour survey of all the animal and plant life located in the park. Scientists and volunteers collect samples to identify and study. This activity can be simulated on school grounds. First introduce students to the *Wildlife is All Around Us* booklets provided free of charge from the 4-H Conservation Program. Use *Book 1. The Wildlife Detective* for the school mini-bioblitz.

Have the class read, answer and discuss the pages about animal groups and being a wildlife detective. Take the class outside. Pair up the students and give each pair a small paper bag and a small paper cup. Have the students collect signs of wildlife and plant life by putting small items in their bags. (Example: an acorn top shows the trees found on the school ground and supplies evidence of squirrels or chipmunks.) Have the students report larger or uncatchable sightings to the teacher and the teacher should keep a record for the class. In the classroom provide students with field guides and give them time to identify the samples they collected. Add the sightings that the teacher kept track of and post the findings so that they can be added to as students see or find more evidence of life on the school grounds before school or at lunch time. Be sure to release all live specimens and keep students away from wasps and bees.

Biodiversity

Biodiversity means biological diversity or the variety of life. It includes plant and animal species and the ***ecosystems*** of which they are a part, as well as the genetic variations within species. People are also considered a part of the biodiversity of our planet. (*Wild About Life Instructional Guide*). Have students take the Biodiversity I.Q. Test on the World Wildlife Fund Website at *www.worldwildlife.org*. Allow students to explore the site, check their answers and write a short paragraph about what biodiversity means.

Habitat Maintenance

The three main components of a *habitat* are food, water and shelter. For a group of animals to live there must be a balance between these factors. Changes in wildlife population alter the balance in a habitat. Have the students go outside and participate in a *Project Wild* Activity called "Oh Deer". Have the class count off in fours and separate into the ones, twos, threes and fours. Mark off a space of about 20 yards in length with cones or string pieces of rope along the ground. Have the ones stand behind the marks on one side of the area. Have the rest of the students stand behind the markers on the opposite end. The ones will pretend to be deer. Review with the students what they need for survival as deer. Discuss that deer need food, water and shelter to live and that they also need greenspace. Explain that for this activity the marked off area will be enough space for the deer population. The object of this activity is for the deer to find what it needs. If a deer is looking for water it should put its hands over its mouth. If a deer is looking for food it should put its hand on its stomach. If a deer is looking for shelter it should put its hands over its head. A deer can choose what it is looking for at the beginning of each round but may not change what it is looking for when the round is in session. When the deer sees what it needs it should approach it quickly, touch it and lead it back to the deer starting mark. The twos, threes and fours are the food, water and shelter. These students should depict what they are the same way as the deer do; that is hands on stomach for food, hands on mouth for water, hands over head for shelter. To begin have the students line up on their respective marks. (Deer on one side of the playing area and resources on the other). Instruct the students to turn their backs to the students on the other line. Have the deer decide what they are looking for. Have the resources what they are. Give the students time to get their hands in place. Tell them that they cannot change what they are until the next round. When the students are ready call one..two..three. At the count of three each deer and each habitat component should turn and face the opposite group with its hands clearly visible. Keeping hands in place the deer should capture a resource and take it back to the deer starting point. If any deer do not find what they are looking for they die and must remain with the habitat components. In the next round they will be a resource for the deer that are left. When more than one deer reaches a resource the student who get there first survives. If no deer needs a particular resource that student stays put ,but can change to another resource in the next round. Have the students complete 15 rounds and chart the deer population. At the end discuss the results with the class. Talk about the herd size and how it changed over the rounds and why. Have students relate this to the real world. (There are extension activities in the *Project Wild Activity Guide*.)

Great Parks

Pittsburgh has over 1,700 acres identified as park lands within the city. The four great parks are Frick, Schenley, Riverview and Highland. Park planners left nothing to chance when designing the lawn areas, nature trails, scenic drives, colorful gardens, playing fields, children's areas, water systems and woodlands. Have students read descriptions of the parks in the booklet *A Guide to Pittsburgh's Great Parks.* Have students choose a park, perhaps the one closest to their home, and design a natural attraction to be added to the park or the expansion or an existing attraction. Have students research the attraction to learn what materials, space and resources would be necessary to add the attraction to the park. Students build 3-D models of their ideas. Students could write letters to the Pittsburgh Parks Conservancy or to the Department of Parks in Pittsburgh to explain their ideas

Employment

There are many jobs in the field of science held by Pittsburghers. Scientists are everywhere and the information that scientists present to people has many forms.

This section will look at how the science that is all around us can be identified, explained and "advertised." It is in this section of the curriculum that the science and art teacher will work together and that outside resources such as the student design teams from Carnegie Mellon University might present information to the classes. Also, this part of the unit could be done after any section of the curriculum and the signs could be made as an ongoing process rather than a culminating activity.

Sign Design

Discuss the purpose of signs with the class. Have students list the signs that they see on the way to school. Explain that the primary purpose of a sign is to convey a message. Ask students to decide if the signs that they listed did the job of getting a message across or not. Tell the students that they are going to design a sign to explain how science relates to some thing or some place in or around the school. An example would be a sign near the light switch explaining how electricity reaches the school. Most of the information was presented in the section on housing however students can do additional research to complete signs. Before beginning work on the sign review the components of a well-made sign. A well-made sign needs ***balance.*** This means it must have equal parts that are pleasing to the eye. The layout of the sign should be based on its purpose with the main idea or word highlighted and the other information near it. A well-made sign needs ***rhythm***. This relates to the lettering. Never use more than two styles of letters because it breaks up the observer's rhythm of reading. ***Unity*** is the next important component. This means that the letters or illustrations on the sign should be set up in a pattern so that the eye travels over the sign uninterrupted from the primary message to the secondary information to the illustration. Remind students that we read from left to right so that any sentences or phrases in the sign should be set up that way. The last main component is ***harmony*.** A successful sign layout means a combination of proper lettering, appropriate color, and complimentary art (illustrations, borders, symbols) After reviewing the basic principles of a layout have students think about one of the topics covered in citiology and create a sign that could be posted in or near school to explain a science concept related to the site of the sign. Students may need time to look around the school, go back through their papers or research topics. Design teams should be set up. Each team will work together using their individual strengths to design a sign. All signs should be sketched in rough draft form and proofread. At this point of the unit the art teacher would work with the science teacher for an interdisciplinary lesson(s). The media that could possibly be used for the actual signs can then be determined by the art and science teachers. Design teams should create mock-ups of the signs to be used in a presentation . (*Sign Web* Website)

Marketing

Once the sign designs are completed and approved in class and the medium decided upon design teams must prepare presentations to get permission and funding for the sign construction and mounting. Design teams will be asked to make a Powerpoint presentation to the principal that explains the purpose of the sign (objective), the information that the sign presents (content), where the sign will be hung, (location) ,the people that the sign will be made for (audience), an example of the sign (*prototype*) the supplies needed to make the sign (materials)and the funds needed to buy the materials and hang the sign (cost). If students need instruction on the basics of Powerpoint have them visit the PowerPoint in the Classroom website at *http://www.actden.com.* This website is sponsored by Microsoft and has a teacher's guide and printed tutorials.

Once the slide shows are complete give the design teams time to practice their presentations. The presentation should include a Power Point slide show with a sample sign. Students can be creative in preparing their presentations. When the slide shows are completed and checked set up a meeting with the principal and custodian and have the design teams try to sell their ideas to the school authorities.

Careers

The last endeavor of the section on employment is to expose students to the many careers that involve science that are open to women and men in our city. Ask students to think about all of the topics covered in the curriculum and which ones they were most interested in. Finding a career in Pittsburgh means combining available work with interests, abilities and personality. Have students look at the top fifty employers in

Pittsburgh as published by the Pittsburgh Post Gazette. Spend time discussing what types of jobs might be found at each of these places, concentrating on science related work.

Have the students explore their interests by using the Missouri Career Interest Game information. Students decide whether they are realistic, investigative, artistic, social, enterprising or conventional based on the descriptions from the Interest Game. The game is online at*http://careermissouri.edu.* Discuss the importance of matching jobs with interests. Next have the students break into small groups and make a list of abilities that a person might need if choosing a career in a science related field. Reassemble the class and put the list on a large piece of poster board to be hung in the room. Lastly, have students complete an activity from the Webquest on Careers at*http://www.csis.pace.edu/schools/nr/creagan/personality2.htm*

Armed with all of this information each student should choose a job that she or he would like to hold at one of the employers on the Pittsburgh list and compose a resume.

Annotated Bibliography for Teachers

Books

A Guide to Pittsburgh's Great Parks booklet, Pittsburgh Parks Conservancy, 2001 (This booklet contains histories of the four great parks, maps and present day attractions.)

Dupre, Judith, Bridges: *A History of the World's Most Famous and Important*, Black Dog and Leventhal Publishers, 1997. (This book provides pictures and drawings of world famous bridges.)

Faraday, Michael, *Chemical History of a Candle*, Explorer Books by Viking Press, 1963. (There are many activities in this book that cross disciplines and grade levels as students look at candle flames from different perspectives.)

Farndon, John, *What Happens When…?,* Scholastic Press,1996. (This book explains and illustrates how everyday items work.)

GEMS (Great Explorations in Math and Science), *Mystery Festival*, University of California at Berkley, 1994. (This is an entire curriculum for teaching forensic science that can be used by primary through middle school.)

Just Add Water, Classroom Curriculum, HACH. (This is an activity kit with a printable curriculum guide.)

Perry, Sarah, *If*, Children's Library Press,1995. (This is a book of open-ended "if" statements whose illustrations will spark imaginative thinking in students)

Petroski, Henry. Engineers Dreams: *Great Bridge Builders and Spanning of America,*Knopf, 1996. (This book provides pictures and drawing of world famous bridges.)

Project Wild, Activity Guide, Council for Environmental Education, 1983. (This is a publication of activities about the environment.)

Scieszka, Jon and Lane Smith, *Math Curse*, Viking Press,1995. (This is a picture book that can be read aloud to let students know that math and science are everywhere.)

Sebak, Rick, *The Mon, the Al and the O*, WQED productions, 1995 (This video is an enjoyable and informative look at Pittsburhg's rivers.)

VanCleave, *Janice, Physics for Every Kid*, John Wiley and Sons, 1991 (This book provides short and easy experiments that deal with all aspects of physics)

Water Cycle Model Teacher's Manual, Hubbard Scientific,1994. (This is a guide that comes with the model of the water cycle and contains instructions, worksheets and transparencies.)

Wellnitz, William, *Be A Kid Physicist*, McGraw-Hill, 1993. (This book provides simple explanations and activities that relate to the laws of physics.)

Wiese, Jim, *Roller Coaster Science*, John Wiley and Sons, 1994.(This book has activities for students to do at amusement parks and playgrounds.)

Windows on the Wild, Biodiversity Basics, World Wildlife Fund, 1999 (This is a teacher's guide with many activities about animals.)

Youngfleish, Kristy, *Wildlife is All Around Us*, Penn State Cooperative Extension, 4-H program. (This is one booklet in a series that can be obtained for classroom use from the 4-H Club. It provides much information about animals in our area.)

Websites

http://www.eecs.umich.edu Newton's Apple, Murder Mystery, (This website provides numerous forensic science and extension activities.)

http://www.schoolnet.ca/vp-pv/fscience/e/stdinfo/std4.htm

Forensic Science Project- Physical Evidence (This website provides activities to do with students that deal with crime scene evidence.)

http://www.swe.org SWE, Civil Engineering Site (This website provides information about bridges and roads with suggested classroom activities.)

wwwpbs/wgbh/buildingbig/tunnels Building Big Website (This is an interactive website for students. It contains a tunnel building activity.)

http://www/inventorsmuseum.com/television.htm Online Inventor Museum (This site gives a narrative history of television.)

http://www.pbskids.org/zoom/do/thaumatropes.html PBS Kids (This website provides many activities and projects for students.)

http://cosmos.colorado.edu/~urquhart/play/pendulum.html Playground Physics (This website provides experiments for young students using palyground equipment.)

www.girl.com Girl Tech (This is an interactive website for students to share ideas about inventions.)

http://www.signweb.com/design/cont/sugnlayout.html Sign Web (This website provides basic information about sign design and layout.)

http://www.actden.com Power Point in the Classroom (This website teaches students to develop a Power Point presentation.)

http://www.post-gazette.com/99top50/list.asp Pittsburgh Post Gazette (This page provides information concerning employment in Pittsburgh)

http://career.missouri.edu/article.php?sid=146 MU Career Center (This website offers students a chance to participate in an interest survey game.)

http://www.csis.pace.edu/schools/nr/creagan/personaliyt2.htm Career Webquest (This is a career lesson taught by using internet resources.)

http://www.Pgh2o.com PWSA. (This is the Pittsburgh Water and Sewage Authority Homepage and has historical as well as updated information about Pittsburgh's water.)

http://www.geocities.com/Heartland/Acres/6690/chemistry.htm Chemistry Experiments (This website provide experiments that use carbon dioxide as a component)

Reading List for Students

Cobb, Vicky, *Why You Can't Unscramble An Egg,* Lodestar Books, 1990. (This is a humorous book about the properties of matter.)

Cole, Joanna, *The Magic School Bus at the Waterworks,* Scholastic Incorporated, 1986.

(This book is a tour of a water treatment plant and has excellent information and illustrations.)

Goldwyn, Martin, *How A Fly Walks Upside Down,* Citadel Press, 1989. (This is a question and answer book about science facts for students.)

Siegel, Alice and Margo McLoone, *Kids' Almanac,* Houghton Mifflin Company, 1992.

(This book is an easy reference for facts and explanations for students.)

Tison, Cindra and Mary Jo Woodside, *The Ultimate Collection of Computer Facts and Fun,* Macmillan Publishing, 1991. (This book contains background information and activities for computers.)

The Handy Science Answer Book, Carnegie Library of Pittsburgh, Viking Press, 1997.

(This book has a wealth of science information presented in an entertaining manner for students.)

Ontario Science Center, *Science Works,* Addison Wesley Publishers, 1994. (This book contains experiment ideas that can be done at home.)

The Oxford Children's Book of Famous People, Oxford University Press, 1994. (This book lists many inventors and explains their contributions in simple terms.)

The Handy Science Answer Book, Carnegie Library of Pittsburgh, Viking Press, 1997.

(This book has a wealth of science information presented in an entertaining manner for students.)

Materials List

Sweet Tarts or M&M Candies (These dissolve easily in the mouth and demonstrate the first step in digestion)

Candles (Use various sizes. Birthday candles, votive candles or tapers can be used.)

Clay (*Model Magic* or *Play Doh* will work to build a base.)

Plastic Soda Bottles (Collect various shape and sizes to be used in several activities.)

Plaster of Paris (This is easily mixed with water and poured into molds.)

Cloth Scraps (Collect and stain some of them for forensic activities.)

Balance Scales (Regulation scales used in science will work well.)

Coal (Collect a few pieces or purchase them from a science catalog.)

Glass Jars (Collect various sizes for experimentation.)

Water Cycle Model (This kit is available from Hubbard Scientific.)

Asphalt Pieces (Collect several pieces from city areas.)

Crock Pot (Use this to cook the ingredients listed in the recipe.)

Straws (Boxes of plastic, bendable straws will be used for bridge building.)

Toy cars (Small model cars can be used.)

Bucket (A large heavy bucket would work well.)

Slinky (Plastic *Slinkys* will work if metal are not easy to obtain.)

Cups (Disposable cups of various materials should be used.)

Shoe Box (Have students bring in boxes from home.)

Smoky Sue Doll (This comes with instructions and can be ordered online.)

Yo-yo (Any size or type will do.)

Metallic Bulletin Board Paper (This shiny paper comes in rolls. (Use silver.)

Standards

1. All students explain how scientific principles of chemical, physical and biological phenomena have developed and relate to real-world situations.

2. All students will demonstrate knowledge of basic concepts and principles of physical, chemical, biological and earth sciences.

3. All students explain the relationships among science, technology and society.

6. All students develop and apply skills of observation, data collection, analysis, pattern recognition, prediction and scientific reasoning in designing and conducting experiments and solving technological problems.