



CREATING DYNAMIC LEARNING COMMUNITIES
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Summer Institute

June 14-16, 2009

Sample Curriculum Secondary Math & Science

Presented by *Highly Effective Teaching* Associates

2009 Summer Institute – Granlibakken, Lake Tahoe, California

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Sample HET Curriculum: Secondary Math & Science

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Organizing Concept for the Yearlong Theme: Change is an ongoing process by which people, places, or things are modified, transformed, and or replaced. By understanding change, we are better able to make educated decisions that have a positive impact on ourselves and the world around us.

Yearlong Theme Kid-Grabbing Title: “You must be the change you wish to see in the world.”

Mahatma Gandhi

Concept for the Component: Cause and Effect

Component Kid-Grabbing Title: Take a stand! Make your Mark!

Being There Location(s) for the Component: Electrical Generating Station, Waste Water Treatment Plant, Power Plant (Steam, Nuclear, etc.), Fuel production plant, Water Treatment Plant

Guest Speaker(s) for Component: Water Works Engineer, Environmentalist, Waste Water Management Engineer, Power Company Public Relations Rep.

Conceptual Key Point for the Component: Cause and effect suggests all people, places and things are connected. To understand cause and effect, we must first understand these elements, their make-up, interactions and the impact on each other and the overall outcome. As humans, all of our actions make an impact. Evaluating our everyday choices helps us control our personal impact.

Guided Practice Inquiries:

1. With your learning team, create a domino structure that uses all of the dominoes provided and effectively knocks down all structures designated by the instructor. Take pride in the advanced structures that provide a higher level of difficulty. Each member of the team should aid in the design of the structured maze. Record the outcomes of each test run. One member should record the cause of difficulties, while another member should record the effects. All teammates should evaluate problems to improve the effectiveness of the maze. At the end of the hour, we will test all mazes for success. (BK, S, L)
2. With a partner and the Lego sets provided build a structure using all the Legos in the set. After building a “secret” structure, describe it to the other pair in your team without letting them see it. After 2-3 minutes of description, compare structures. Record the similarities and differences between the structures, then brainstorm “What went wrong?” or “What we did well?.” (S, BK)

Inquiries:

1. Partner with two other learning teams (8-12 people). In a circle, hold someone’s hand across from you (it cannot be someone next to you), creating a “human pretzel.” While the music plays work as a team to untie the knot without unhooking hands. When the music stops, talk with your teammates about the effect each movement will make and plan the next move. As the activity continues, try to remember at least 3 major moves that were most effective and why. When the knot is untied, record the 3 moves and discuss what could have helped and why. (BK, S, L, M)
2. List as many action producers as you can try to generate at least 8 examples of people or things that generate an effect. Choose a method to exhibit the cause and the effect generated by each example. Be prepared to share this information with the class. (L, LM)
3. Assign each person in your team one of the following roles: 1) Architect, draws plans for the design 2) Engineer, builds the device 3) Scientist, records all observations, times device 4) Statistician, measures distances traveled, calculates speeds. As a team, build a paper airplane out of one sheet of 8 X 11.5 white paper. Design the airplane with the intent of flying the farthest distance. Calculate the speed the airplane travels speed = distance traveled / time(s). The teacher will provide a weight; add this weight to your design and try again, recording all observations and recalculating airplane speed. Repeat this process until instructed otherwise. Additional weight is the cause for change in the flight of your airplane, what are the observed effects? (S, LM, L, BK)

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4. As a class, form a circle. The instructor will toss a ball to one person in the circle, who will toss it to another person in the circle this pattern will continue until every person in the circle has received and thrown the ball. No one can touch the ball twice until everyone has touched it and it has returned to the instructor. The instructor may start another ball and it must go in the same pattern. The goal is to see how many balls can be traveling through the circle simultaneously. Watch for a pattern that explains the cause of problems that occur in the challenge.
5. Waste water treatment plants are where sewage and waste water is treated or processed to return to the water table as reclaimed water or “cleaned” water usually appropriate for human use. The most common energy generation is converted to electricity. Take a tour of an energy generating station. While on the tour, record all types of energy observed (solar, hydroelectric, mechanical, chemical, thermal, electrical, or nuclear). Look for the effects of energy generation on the surrounding environment, as well as the causes of any problems or outcomes. (LM, L, S, BK)

Significant Knowledge Key Point #1: Water is one of the most important molecules on earth. All living things need water to survive. Approximately 75% of the human body and the earth are composed of water. 97% of the earth’s water is salt water and less than 1% of the earth’s fresh water is consumable by humans. There are many usages for water including consumption, agriculture, industry, transportation and recreation. Learning the importance of water and the factors that endanger it will help us make educated decisions about our impact as well as encourage us to be more conscious of usage in order to conserve and respect our water supply.

Guided Practice Inquiries:

1. Discuss as a class the ways that you used water since you started your day. After the list is created on the overhead, discuss with your learning club what would happen if there were no water. Share your conclusions with the class. (L, LM)
2. Demonstrate (using the materials given) the percentages given from Mr. Mears. Work with your learning club. Stand once your group has the solution. (BK, LM, S)

Inquiries:

1. With your learning club, create a written list of the ways those students in the group use water on a daily basis. The list must be only for the students in the learning club. Your group will be given 3 minutes to generate as many usages as possible. Write your list on a sheet of notebook paper. Be prepared to share. (L, LM)
2. View the water video and write down examples of water usage from the clip. At the end of the video, compare your usages with others at your table and create a comprehensive list on chart paper. The final copy may use symbols, sketches, and/or written words. Colored pencils, blue or black ink, and/or a no. 2 pencil may be used. The final product must be neat (personal best). Be prepared to share. (S, L)
3. Using members of the class, show the percentage (%) of water on earth that is available for drinking. Each member should represent a molecule of water. Demonstrate the difference if 10% of the water on earth were usable for consumption. Be prepared to support your conclusion. (BK, L)
4. With your learning club, using beans, demonstrate the percentage of water on the earth that is usable for consumption. Using a second set of beans show the percentage of the human body that is composed of water. From both models, remove 10% of the water (usable in the earth model). Discuss with your learning club what the effects of removal of that water might have. Be prepared to share. (LM, L, BK)
5. Create a short story or a children’s book explaining the importance of water to humans. The story must include the statistics listed in the key point. Give the reader possible scenarios if we conserve water and if we don’t conserve water. Either story that you choose should include colored sketches or clips from either the computer or magazines. The story may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. (L, S)



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Significant Knowledge Key Point #2: Water is composed of 2 atoms of Hydrogen and 1 atom of Oxygen. The water molecule forms in a “Mickey Mouse” shape. The hydrogen atoms form a more positive side and the Oxygen atom is more negative. These positive and negative ends create a *polar* molecule. The positive ends of water attract molecules that are negative and the negative ends of the molecule attract positive molecules. This attraction is similar to a magnet or a battery. These bonds can form between any molecule that has a positive and negative end. Understanding the structure of water enables us to make educated predictions on the interaction of other chemical compounds that are introduced into water and how these combinations create unwanted systems called pollution.

Guided Practice Inquiries:

1. Discuss with your learning club what Polar means. From your discussion, create a definition of your own and share it with the class. Make sure to include examples in order to help the class remember your definition. You may use a dictionary and any of the resources provided. (L, S)
2. With two other students, form a molecule of water. Each member of the team (atom) must be labeled as Hydrogen or Oxygen. Use tape to label the positive end and the negative ends of the molecule. When the group has demonstrated that the molecule is correctly formed and labeled, form a bond with another molecule of water (3 other students). Repeat the process as instructed. (BK, LM)

Inquiries:

1. Working with a partner, complete the “water on a penny” lab. Using a penny, a water dropper and water, see how many drops that can be placed on the penny without spilling over the edge. Make sure to observe the shape of the water on the penny. Create a sketch of the shape on your handout. Complete the experiment 10 times. The lab results should be written on the handout in pencil. From the data, calculate the mean, making sure to show all calculations. Be prepared to share your results with the class. (S, BK, LM, N)
2. Using marshmallows, toothpicks, and dot candies, create a model of water. Show the teacher the hydrogen and oxygen atoms in your molecule. Explain which ends are positive and negative. Combine each person’s water molecule in your learning group. After showing the class, combine all of the molecules together to form a class water compound. (S, LM, BK)
3. Working with a partner, complete the “water in a cup” lab. Using a cup, a water dropper and water, see how many drops can be placed in the cup without spilling over the edge. Make sure to observe the shape of the water on the top of the cup. Create a sketch of the shape on your handout. Complete the experiment 5 times. The lab results should be written on the handout in pencil. From the data, calculate the mean, making sure to show all calculations. Be prepared to share your results with the class. (S, N, BK, LM)
4. Create an acrostic poem using the word POLAR. Each letter must begin a sentence or sentences. The complete poem must clearly explain what polarity is and how it is created. Examples should be used in your poem. The poem may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. Be prepared to share with the class. (L, LM, S)
5. Write a short essay explaining how water is polar. Make sure to include how this affects water and its interaction and uses with other materials. The final product must be typed using 14 point, times new roman font. Make sure to include a diagram of water that is labeled. (L, S)

Significant Knowledge Key Point #3: An *atom* is a system and also a part of other systems. It is the smallest particle of an element (pure substance made of only one kind of atom) that retains the chemical properties of that element. An atom is composed of two regions: the *nucleus* and the *electron shell*. The *nucleus* is a very small region located near the center of the cell. The nucleus contains at least one positively charged particle called a *proton* and usually one or more neutral particles called *neutrons*.

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Surrounding the nucleus is a large region (compared to the nucleus) occupied by negatively charged particles called *electrons*. This region is often referred to as the *electron shell, which contains energy levels*. Protons, neutrons, and electrons are often referred to as *subatomic particles*. Understanding the structure of an atom is important so that we are able to predict the combination of these atoms needed to form chemical compounds.

Guided Practice Inquiries:

1. As a learning club, create a list of facts that you know about atoms. The list should be all-inclusive (for sure facts and not for sure facts). The information must be listed using complete sentences. Make the list on 8 x 11 notebook paper using pencil or blue or black ink. Be prepared to share your information with the class. (L, LM)
2. As a class, create two concentric circles. Label each circle as the nucleus and the electron shell. Place extra members in each region and label each member. Repeat the activity as Mr. Mears gives specific elements. (BK, S)

Inquiries:

1. Working alone, draw an atom using one of the elements listed on the overhead (from Mr. Mears). Place the protons, neutrons, and electrons in their proper place in the picture of the atom. Use a different color for each of the regions and subatomic particles. Each region and subatomic particle must be labeled and include a definition. Proper spelling must be used. (S, LM, L)
2. Work with your learning club. The group will be given tape, construction paper, and copy paper. Using the materials given, create a large model of an atom on the floor of the element Hydrogen (1 proton, 1 neutron and 1 electron). Your group must identify and define each of the regions in an atom and subatomic particles. Present your model to the class. (S, BK, LM, L)
3. Working alone, write a paragraph demonstrating your knowledge of an atom. The paragraph must explain the regions and subatomic particles of an atom. Your final paper may include a picture as an addition to the paragraph. The paragraph may be typed using 14 point, Times New Roman font or may be hand written using blue or black ink on 8 x 11 notebook paper. Be prepared to share your paragraph with the class. (L, S)
4. Create a PowerPoint presentation demonstrating your knowledge of an atom. The presentation must explain the regions and subatomic particles of an atom and include the definition of each. The slide show must use color and include both text and pictures (drawings). Transition between slides must be whole text or whole page (no individual letters). Use proper spelling, punctuation and grammar. Save the power point on a 3.5" floppy disk or email the slide to tmears4@cox.net. Be prepared to present your slide show to the class. (L, S)
5. Search for news, radio, internet or magazine articles addressing atoms use or identification in the news. Summarize the article identifying the attributes of atoms described in the key point. (LM, L)
6. Research an atom of any element from the periodic table. Prepare a demonstration to the class about your atom. Include a sort paragraph giving the details discovered. Also include a labeled diagram with all of the regions. Be prepared to share. (S, L, LM)

Significant Knowledge Key Point #4: *Pollution* is the accumulation and adverse interaction of unwanted compounds (contaminants) in a mixture. The living organisms most commonly associated with pollution are humans, either directly or indirectly through their activities with other organisms. Humans can pollute directly by applying excess fertilizers or pesticides, or we can pollute indirectly by mismanaging cattle feedlots. These pollutants react with natural needed resources in our environment creating contaminated, unusable systems with our needed resources. Water and air are two compounds that are polluted. Understanding the chemistry of pollutants and water or air can help us better understand the importance of prevention and removal of pollution from the mixtures.



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Guided Practice Inquiries:

1. Take a look at the local newspaper. Look for any articles that are written about contaminants in your area. Share your findings with the class. (L)
2. Working with your learning club, create a list of as many pollutants that you have heard of. Share your list with the class. (LM, L)

Inquiries:

1. Fill a beaker with pure water. Place one drop of food coloring in the water. Time how long it takes for the drop of color to completely dissolve. On a sheet of paper, describe in writing how the food coloring dissolved and the time it took. Observe a drop of water and food coloring on the microscope. Sketch a picture of the slide on the same sheet of paper listed above. The sketch should be drawn using color. Be prepared to share the results of this lab with the class. (S, BK, LM, N)
2. Using the Internet or the local newspaper, research and make a list of common pollutants in your area. Describe the pollutant and the source from which it comes. Include as much information about the pollutant as possible (polarity, structure, how it is harmful, and to whom or what the pollutants are most harmful). The list may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. Be prepared to share with the class. (L, S)
3. Create a flyer that informs the reader of the pollutants found in your area. Describe to the reader why and how the pollutant is harmful to your environment. Create the flyer on an 8 x 11 sheet of copy paper. The paper could simply be a handout or it may be tri-folded. The flyer must have color and pictures in addition to the written text. Your final product needs to be in neat handwriting (personal best) or may be typed using the font of your choice. Students must use proper spelling, grammar and punctuation. Be prepared to share your flyer with the class. (L, S)
4. Create a song, chant, or a poem describing pollutants. It should include the definition of pollutants and why they are not desirable. The lyrics must be written using blue or black ink in neat handwriting or typed using Times New Roman 14 point font. Slang is acceptable as long as the slang lyrics are defined. Read or sing your final product to the class. (M, L)
5. Cut pictures from magazines or sketch pictures that represent examples of pollution or pollutants. There should be a picture for each letter of the word POLLUTION. Label each picture with correct spelling in blue or black ink using personal

Significant Knowledge Key Point #5: A *compound* is a substance that is made from the atoms of 2 or more elements that are chemically bonded. Chemical compounds tend to form so that each atom, by gathering, losing, or sharing electrons, has an octet of electrons in its highest occupied energy level. This is called the octet rule. The exception to the octet rule is the first energy level, which is full with 2 electrons. Compounds are made up of chemical bonds. *Chemical bonds* are formed when two atoms interact in order to become more stable. Atoms form chemical bonds to create a stable compound. A molecule of water is held together with 2 chemical bonds. There is a chemical bond between the Oxygen atom and both of the Hydrogen atoms. Oxygen has 6 electrons in its outer electron energy level and Hydrogen has 1 each. By sharing the electrons, the outer energy level of Oxygen has an octet. Understanding how atoms react to form compounds help us understand how new (wanted or unwanted) compounds can be formed.

Guided Practice Inquiries:

1. Using a dictionary, look up the word COMPOUND. Use a combination of words and pictures to demonstrate a compound. You may use colored pencils, or any other writing instruments. Draw or write your final product on a sheet of 8 x 11 copy paper. Be prepared to share with the class. (L, S)
2. With a partner, create a physical bond using your hands and or feet. After testing the strength of your bond, discuss with your partner how the bond could be strengthened. Compare your bond with



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possible chemical bonds such as Hydrogen and Oxygen or Sodium and Chloride. Discuss what could make these chemical bonds weak or strong. Be prepared to share with the class. (BK)

Inquiries:

1. Using the materials given, create compounds given by Mr. Mears. When your group has it completed, stand and share your results. (BK, LM, S)
2. Take a look at the elements listed on the handout. What is the number of electrons needed for each to make it stable. List the possible elements that could bond with that element to create a compound. (L, LM)
3. From the list of elements given, calculate the number of electrons each atom would need in order to form an octet of electrons in the outermost electron energy level. From the list, predict which elements could bond to create a chemical compound. The work should be done using pencil on 8 x 11 notebook paper. Be prepared to hand in your final work. (LM, S)
4. From the handout, create chemical compounds for each group of elements listed. Show the number of atoms needed of each and write the new compound. Show all work for credit. You may use any method needed to calculate the electrons for each atom from the periodic table of elements. Show your work on a sheet of notebook paper. Be prepared to hand in your assignment. (L, LM, S)
5. Using the materials given, create a molecule of water (2 Hydrogen atoms and 1 Oxygen atom). Label the electrons, protons, and neutrons and the nucleus, and electron energy levels of each atom in the molecule. Describe how and why the molecule is stable. Be prepared to share your final project. (S, L, LM)

Significant Knowledge Key Point #6: *Covalent* and *ionic bonds* are 2 specific types of chemical bonds. A covalent bond is a chemical bond resulting from the sharing of an electron pair between two atoms to create a *molecule*. Water, oxygen, and sucrose (table sugar), represent a few examples of molecular compounds. Ionic Bonding is the bonding that results from the electrical attraction between large numbers of *cations* (positively charged atom(s)) and *anions* (negatively charged atom(s)). Sodium Chloride (table salt) and Calcium Chloride are two examples of compounds made up of ionic bonds. Covalent bonds, though strong, are not as strong as ionic bonds. Bonding between atoms of different elements is never purely ionic and rarely purely covalent. It usually falls somewhere between these two extremes. By understanding the bonding in each of these compounds, we can understand how and why these systems can be added or removed from mixtures (systems).

Guided Practice Inquiries:

1. List as many examples of bonds in real life. List the components that work together to create these bonds. Write whether you think these bonds are strong. Be prepared to share. (LM, L)
2. Create a three column char. Label the columns as Ionic, Covalent, and Both. Fill in each column accordingly. Be prepared to share. (LM, L, S)

Inquiries:

1. Work with a partner. Using ping-pong balls, demonstrate covalent and ionic bonds as the instructor announces them. Switch partners and complete the demonstration again. Be prepared to support your conclusion. (BK, S)
2. In your own words, define covalent and ionic bonds. Your definition should clearly define all of the properties of the bonds, give examples and explain why the examples are covalent or ionic. You may include pictures clipped from magazines or neat hand sketches. Your final product must be on 8 x 11 notebook paper. Be prepared to turn in your assignment. (L, S)
3. Create a 3 – 5 minute Power Point slide presentation explaining covalent and ionic bonds. The slide must clearly define each bond and give an example with a picture. The slide must use color and transitions must be whole-text. Save your presentation to a thumb or flash drive or email it to ahanks@kUSD.org. Be prepared to share with the class. (S, L, LM)



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4. Create an acrostic poem using the words COVALENT and IONIC. Each letter must begin a sentence or sentences. The complete poem must clearly explain what each type of bond is and how these bonds create compounds. You may also list examples of compounds that form from these bonds. The poem may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. Be prepared to share with the class. (L, LM, S)
5. Draw a Venn diagram. Label one circle Covalent Bonds and the other circle Ionic Bonds. List the facts for each that are different and in the overlapping section show the similarities. The circles must be drawn using an entire sheet of copy paper. Students may use colored pencils and/or a #2 pencil. The diagram must have a title. Be prepared to share. (LM, S, L)

Significant Knowledge Key Point #7: There are two types of bonds formed in covalent molecules: *polar covalent* and *non-polar* bonds. A polar covalent bond is a bond in which the bonded atoms have an unequal attraction for the shared electrons. Polar covalent bonds generate a polar molecule (a slightly negative and positive end). Water is an example of a polar molecule. A non-polar covalent bond is a bond in which the bonding electrons are shared equally by the bonding atoms, resulting in a balanced distribution of electrical charge. Since the atoms share the electrons and their charge equally there is no attraction on surrounding atoms. Most carbohydrates are non-polar covalent molecules. Crude oil is non-polar. Non-polar molecules are less stable than polar molecules. By understanding the polarity of a molecule, we are able to suggest the reactivity and further suggest possible ways of adding or removing atoms and elements found in pollutants in our water.

Guided Practice Inquiries:

1. With your learning club, generate a list of things that you have heard about or the things you might know about polarity (3 minutes). Be prepared to share your list with the class. (L)
2. Draw a Venn diagram. Label one circle polar covalent and the other circle non-polar covalent. List the facts for each that are different and in the overlapping section show the similarities. The circles must be drawn using an entire sheet of copy paper. Students may use colored pencils and/or a #2 pencil. The diagram must have a title. Be prepared to share. (LM, S, L)

Inquiries:

1. Research one polar and non-polar molecule. Give the use of the molecules and include a diagram of each showing their bonds. (L, S, LM)
2. Create a movie for younger students teaching them the difference between polar and non-polar. Make sure to include examples and how these bonds are similar and different. Type your script and record the movie or act it out for the class. (L, BK)
3. Write a paragraph demonstrating your knowledge of polar and non-polar molecules. The paragraph must educate the reader on the topic. Your final paper must include a picture (in color) in addition to the paragraph. The paragraph may be typed using 14 point, Times New Roman font or may be hand written using blue or black ink on 8 x 11 notebook paper. Be prepared to share your paragraph with the class. (L, S)
4. Read the handout given. Have a discussion at your table about why the chemical compounds did or did not dissolve in water. Be sure to identify the type of bond created. Present your conclusion to the class and be prepared to support your theory. (L)
5. Using the Difference of Electro negativity (DOE), state whether the listed molecules are formed from polar covalent or non-polar covalent bonds. Show all of your calculations in pencil on an 8 x 11 sheet of notebook paper. Be prepared to hand in your assignment. (LM)



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Significant Knowledge Key Point #8: Pollutants may be polar, non-polar, and/or ionic compounds. Each of these pollutants interacts with water differently, and each requires a different method for purification. Non-polar bonds are weaker than polar bonds, which are weaker than ionic bonds. Non-polar pollutants such as oils tend to separate from water because of the polar properties. Polar and ionic compounds tend to dissolve in water making them more difficult and expensive to remove. By understanding the chemical interaction and properties of each of these molecules, we are able to understand pollution sources and how these chemicals are introduced to our water supply and the system used to remove these pollutants from our water system. Our understanding provides us the knowledge necessary to educate others about the conservation of our precious water and influence their impact.

Guided Practice Inquiries:

1. Look up the definition to the word PURE. Create a definition in your own words with your learning club. Discuss as a learning club if pure is or is not beneficial and defend your suggestion. Be creative with your definition (use color, pictures, etc.). Be prepared to share your definition with the class. (*L, S*)
2. Place each of the mixtures given in separate containers of water. Make sure that you label each container separately. On the handout given, record your observations for the experiment. Write a theory as to why each mixture reacted differently in water. This theory should come from the discussion about the structure of water and pollutants. Be prepared to share your findings and theory with the class. (*BK, N, S, L*)

Inquiries:

1. From the list of pollutants found in the area, research one (your choice) of them to find its chemical structure (polarity, bonding potential, ionic compound). From the research, decide how the pollutant would react with water and why. Write your findings on a sheet of notebook paper. Be prepared to share. (*L, S*)
2. *Create a flyer that informs the reader of the pollutants found in your area. Describe to the reader why and how the pollutant is harmful to your environment. Create the flyer on an 8 x1 1 sheet of copy paper. The paper could simply be a handout or it may be tri-folded. The flyer must have color and pictures in addition to the written text. Your final product needs to be in neat handwriting (personal best) or may be typed using the font of your choice. Identify the local political candidates and Presidential candidates stance on environmental pollution. Include each candidate's position and voting record on environmental issues. Be prepared to organize a "environmental forum," invite local candidates and community members to discuss pollution in your local water supply. Consider inviting the news media and take pictures for the yearbook or school newsletter.*
3. *From the list of pollutants found in the area, write a persuasive essay to the Mayor and City Council. The essay should inform the readers of the type of pollutants and the chemistry behind why they are a problem for the community. The essay should also give suggestions for prevention and clean up. Students must use proper spelling, grammar and punctuation. The essay will be forwarded to the Mayor and/or City Council.*
4. *From the list of pollutants found in the area, write a letter to the editor of the local newspaper. The letter should inform the reader of the type of pollutants and the chemistry behind why they are a problem for the community. It should also give suggestions for prevention and clean up. Finally, identify national or worldwide pollutants discussed in the media related to climate change or water shortages. The letter will be forwarded to the editor of the newspaper.*
5. From the list of pollutants found in the area, create a PowerPoint slide show informing your audience of the type of pollutants and the chemistry behind why they are a problem for the community. The presentation should also give suggestions for prevention and clean up. The slide show must use color and include both text and pictures (drawings). Transition between slides must be whole text or whole page (no individual letters). Use proper spelling, punctuation and grammar. Save the power point on a flash or thumb drive or email the slides to tmears4@cox.net. Be prepared to share your poster with others. (*S, L*)



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2. From the class sum of number of siblings, number of pets, and miles from school for each student, calculate the mean of each for the class. After your calculation, compare your solutions to others at your learning club. Show all work on a sheet of 8 x 11 notebook paper completing the calculations in pencil. Be prepared to turn in your assignment. (LM, L)

Inquiries:

1. Record the number of vehicles, the total number of windows, the total number of wheels, and the total number of doors of vehicles in the parking lot. Calculate the mean or average number of windows, wheels, and doors per vehicle in the lot. Show all work on a sheet of 8 x 11 notebook paper completing the calculations in pencil. Compare your calculations to others in your learning club. Be prepared to share your answers with the class. (LM, L)
2. Compare the average income for jobs listed on the handout. From the information given, decide which company you would prefer to work for and why. Be prepared to share your conclusion with the class. (L, LM)
3. From the data given in the handout, calculate the mean for each set. Show all work on a sheet of 8 x 11 notebook paper completing the calculations in pencil. Compare your calculations to others in your learning club. Be prepared to turn in your work. (LM, L)
4. From the national average for employees with educational background, give your opinion as to why these average income per year increase with education. As a learning club, discuss whether you agree or disagree with this statistic? Was the mean useful to your discussion? Be prepared to share. (L)
5. Design a problem from real life numbers that requires calculating the mean. Include the complete solution to the problem. Present the problem to the class. (LM, L)

Social/Political Action Ideas:

1. *Create a flyer that informs the reader of the pollutants found in your area. Describe to the reader why and how the pollutant is harmful to your environment. Create the flyer on an 8 x 11 sheet of copy paper. The paper could simply be a handout or it may be tri-folded. The flyer must have color and pictures in addition to the written text. Your final product needs to be in neat handwriting (personal best) or may be typed using the font of your choice. Identify the local political candidates and Presidential candidates stance on environmental pollution. Include each candidate's position and voting record on environmental issues. Be prepared to organize a "environmental forum," invite local candidates and community members to discuss pollution in your local water supply. Consider inviting the news media and take pictures for the yearbook or school newsletter.*
2. *From the list of pollutants found in the area, write a persuasive essay to the Mayor and City Council. The essay should inform the readers of the type of pollutants and the chemistry behind why they are a problem for the community. The essay should also give suggestions for prevention and clean up. Students must use proper spelling, grammar and punctuation. The essay will be forwarded to the Mayor and/or City Council.*
3. *From the list of pollutants found in the area, write a letter to the editor of the local newspaper. The letter should inform the reader of the type of pollutants and the chemistry behind why they are a problem for the community. It should also give suggestions for prevention and clean up. Finally, identify national or worldwide pollutants discussed in the media related to climate change or water shortages. The letter will be forwarded to the editor of the newspaper.*
4. *Create a short story or a children's book explaining the importance of water to humans. The story must include the statistics listed in the key point. Give the reader possible scenarios if we conserve water and if we don't conserve water. Either story that you choose should include colored sketches or clips from either the computer or magazines. The story may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. Share your story with a class of younger students.*



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5. Create a flyer that informs the reader of the pollutants found in your area. Describe to the reader why and how the pollutant is harmful to your environment. Create the flyer on an 8 x 1 1 sheet of copy paper. The paper could simply be a handout or it may be tri-folded. The flyer must have color and pictures in addition to the written text. Your final product needs to be in neat handwriting (personal best) or may be typed using the font of your choice. Identify the local political candidates and Presidential candidates stances on environmental pollution. Include each candidate's position and voting record on environmental issues. Be prepared to share your flyer with the news media.
6. From the list of pollutants found in the area, write a persuasive essay to the Mayor and City Council. The essay should inform the readers of the type of pollutants and the chemistry behind why they are a problem for the community. The essay should also give suggestions for prevention and clean up. The essay may be written using blue or black ink in neat handwriting or may be typed using Times New Roman 14 point font. Students must use proper spelling, grammar and punctuation. The essay will be forwarded to the Mayor and/or City Council.
7. From the list of pollutants found in the area, write a letter to the editor of the local newspaper. The letter should inform the reader of the type of pollutants and the chemistry behind why they are a problem for the community. It should also give suggestions for prevention and clean up. Finally, identify national or worldwide pollutants discussed in the media related to climate change or water shortages. The letter will be forwarded to the editor of the newspaper.
8. From the list of pollutants found in the area, create a poster informing your audience of the type of pollutants and the chemistry behind why pollution is a problem for the community. The poster should include the two presidential candidate's positions on environment issues and the candidate's plan to address environmental pollution. Give you personal suggestions for prevention and clean up. Be prepared to share your poster with others.
9. From the list of pollutants found in the area, create a PowerPoint slide show informing your audience of the type of pollutants and the chemistry behind why they are a problem for the community. The presentation should also give suggestions for prevention and clean up. The slide show must use color and include both text and pictures (drawings). Transition between slides must be whole text or whole page (no individual letters). Use proper spelling, punctuation and grammar. Save the power point on a flash or thumb drive or email the slide to tmears4@cox.net. Be prepared to share your presentation with others.

Content Standards:

Science:

Content Standard A

- Identify questions that can be answered through scientific investigations*
- Use appropriate tools and techniques to gather, analyze, and interpret data*
- Develop descriptions, explanations, predictions, and models using evidence*
- Identify questions and concepts that guide scientific investigations
- Design and conduct scientific investigations**
- Formulate and revise scientific explanations and models using logic and evidence
- Recognize and analyze alternative explanations and models
- Use technology and mathematics to improve investigations and communications

(a) Content Standard B

- Structure of atoms
- Structure and properties of matter
- Chemical reactions

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(b) Content Standard E

- Design a solution or product
- Abilities of technological design

(c) Content Standard F

- Populations, resources and environments*
- Natural hazards*
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

Math:

- Draw geometric objects with specified properties, such as side lengths or angle measures*
- Use visual tools such as networks to represent and solve problems*
- Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life*
- Work flexibly with fractions, decimals, and percents to solve problems*
- Understand the meaning and effects of arithmetic operations with fractions, decimals, and integers*
- Develop an initial conceptual understanding of different uses of variables*
- Develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes*
- Find, use, and interpret measures of spread, including mean and interquartile range*
- Use symbolic algebra to represent and explain mathematical relationships
- Use a variety of symbolic representations, including recursive and parametric equations, for functions and relations
- Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools

Middle School Standards *

Middle School and High School **

High School

Lesson Design

TJ Mears

Anticipatory Set: After viewing the Rube Goldberg comics and Japanese syste

Learning Objective: A system is a condition of harmonious, orderly interaction. Systems are made up of parts that interact; when one part doesn't work, the whole system is in jeopardy. Being a part of a system requires responsibility to it. Every part of a system is dependent on the other members and when one part changes, so do the responsibilities of the others.

Purpose: In order for a system to maintain homeostasis, each portion must continue to do its part. Most structures are either made up of a system and/or is a part of a bigger system.



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Input:

Brainstorm systems seen in everyday life. Record your list on chart paper.

Discuss the possible causes affecting the stock market (system) changes over the last two years.

Record your list on chart paper.

Modeling: Teacher models successful and unsuccessful systems in real life (Security, Riots, Sunways, etc.).

Check for Understanding: Discuss with your learning club the things needed to cause our class to function well. Chose the five most important things from your discussion and write them on a sticky note. Stick the list on the chart paper labeled in the room “class needs”.

Guided Practice: Form a circle as a class. Suggest the LIFESKILLS needed to keep the ball from hitting the ground as it is tossed to each member in the circle. Test the suggestions. Discuss with the class whether or not this system was successful. Could this system improve? What caused the system to fail (if it did)? (BK, L)

Independent Practice: (Choice Inquiries – Choose One)

1. The stock market is a system that is affected by many things and also has an effect on numerous things. Take a look at the changes in the last two years and make a prediction for these changes. Write your predictions on a sheet of notebook paper (as a learning club). Share your conclusions with the class. (LM, L)
2. From the class discussion about the war on Iraq, identify at least three parts of the military system that makes it function. Also list the effects of the war on your city, your state, our nation, and the world. Write your list in your notebook using blue or black ink or pencil. Share your list with the class. (L)

Closure: Community Circle Reflection: “What I now know about a system is...”

Bibliography:

Resources (teacher and student)

(i) Books:

Issues: Evidence and You, Lawrence Hall of Science, 1996, University of California at Berkeley

Science Explorer: Earth's Water, Prentice Hall, 2000, Upper Saddle River, NJ

Modern Chemistry, Castka, Joseph F., Davis, Raymond E., PhD, Metcalfe, H. Clark, Williams, John E., Holt, Rienhart and Winston, 1999, Austin, TX

Understanding Ground-Water Contamination: An Orientation Manual, Bailey, Paul E. and Ward, William D., Editors, ICF Inc. 1990, Fairfax, VA

The Chemistry of Pollution, Fellenberg, Gu, John Wiley and Sons, LTD, 2000 New York, NY

Pollution Science, Brusseau, Mark L., Gerba, Charles P., Pepper, Ian L., Editors, Academic Press Inc., 1996, Tuscon, AZ

National science Education Standards, National Research Council, 1996, Washington, DC

A Framework for High School Science Education, Aldridge, Bill G., National Science Teachers Associations, 1996, Arlington, VA

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(ii) Web Sites:

www.nctm.org
www.google.com
www.nap.edu
www.mhhe.com
www.usetute.com
www.askjeeves.com
www.marcopolo.com
www.fertilizer.com
www.tulsaschools.org
www.okstate.edu

(iii) Videos:

Water: Gift of Life, The Nature Company, Berkley, CA
Our Precious Water, KPS Video Productions Inc., 1997, Auburn, MA
Water Sheds to Sea Shores, NOAA-MBNMS, 1998, Moey, CA
The Simpson's, Fox Television, 1989 – Current

(iv) Music:

YMCA, The Village People
Mozart, BCI Music, 1997, Westlake Village, CA
Salt Lake Symphony, Caswell, James Michael, Conductor, Abravanel Hall, Salt Lake City, 2001

(v) Local Contacts:

Wet in the City, McIntyre-Coley, Mary, 918-591-4051, WITC@cityoftulsa.org and Parviainen, Anna, PhD, 918-293-1247, aparviainen@att.net
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