

## **Making the Connection between Science and Kitchen Activities; A Curriculum Unit for Secondary Special Needs Students**

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### **The Overview**

This unit contains five mini-units that could be taught over the course of a semester. As a special education teacher who is non-certified in the area of science, but required to teach science to students with special needs, I decided to design this science unit specifically for secondary students with special needs. This unit covers basic science concepts and principles (the scientific method, heat, chemical reactions, safety concerns in the kitchen, and methods to prevent and/or retard food spoilage). During this unit, students are expected to actively participate in hands-on activities. This unit contains related activities that could be used for regular education elementary and/or middle grade students; it also contains suggested activities specifically geared for students with special needs.

### **The Rationale**

One of the best high school science teachers I have had the pleasure to observe in my 30+ years of teaching would frequently remind me why he felt "hands-on" experiences were so vital for his biology students; "tell me, I'll forget; show me, I'll remember; involve me, I'll understand". While I believe that this axiom is true for all students, I believe that it is even more relevant and applicable for students who have been designated as special needs students. In an article entitled, "Why Avoid Hands-on Science?" that appeared in the January, 1997 edition of Science Scope, William J. Sumerall states that "most science educators would agree that a teacher with a weak science background who prefers using the hands-on method will be more effective than a knowledgeable science teacher who prefers to use the lecture method". In the past thirty-one years that I have been a special education teacher, I have encountered no special education teachers (including myself) who possessed a degree in science; while such a person may exist, I have never encountered such a teacher. I firmly believe that a hands-on approach to science can help bridge the gap between a lack of a strong science background (which includes most special education teachers), and the required science instruction that most special education teachers must deliver to their special needs students. It is also my belief that all teachers (even special education teachers) should have an understanding of the chemical processes that occur when doing a hands-on lab with their students. For example in the first mini-unit there is a lab that asks the students, why people cry when they cut onions. Although, my students may never fully compare the chemistry that is involved when onions are cut, I as the teacher should be capable of explaining that when an onion is cut or chopped, a gas is released (the lachrymator agent propanethiol S-oxide). As this gas rises up to your eyes, a chemical reaction between the gas and the water in your eyes occur and sulfuric acid is formed. When your eyes water, it is your body's natural reaction and tears are expelled as a defense against the harmful sulfuric acid. In Pennsylvania the first education standard in science and technology states "All students explain

how scientific principles of chemical, physical, and biological phenomena have developed and relate them to real-world situations". The curriculum that I have developed will fit in with the curriculum that has already been prescribed by the Pittsburgh Board of Education. It will enhance and explain the concepts that are contained within the Board of Education's curriculum while providing practical, real-life applications that could be easily understood by students who have been diagnosed as having educational deficiencies. For special needs students the kitchen (and food) could serve as the catalyst to connect science to real-world, everyday life.

## **Objectives**

It is my expectation that my students will be able to describe and use the scientific method to solve problems. Using the scientific method relates directly to the science and technology content standard number six that calls for students to be able to develop and apply skills of observing, data collection, analysis, pattern recognition, prediction and scientific reasoning in designing and conducting experiments and solving technological problems. Science and technology content standards numbers one, three and four will be reinforced when my students demonstrate the ability to locate items in their kitchen that are dangerous and explain how they (the students) can use these items safely. My students will be able to identify how food spoils and list preventative measures that can retard and/or eliminate food spoilage; this will demonstrate that my students have the ability to apply science and technology content standards number one, two and eight. It is also my expectation that my students will be able to describe how heat is transferred during the cooking process and that they (the students) will be able to explain and describe how chemical reactions take place in the kitchen and this last objective will also demonstrate that my students can apply science and technology standard number one.

This curriculum unit will cover the methods and means of functioning safely in the kitchen. As a special education teacher, I feel it is my duty and responsibility to prepare my students for life in the "real world." This preparation for the real world would certainly include the ability to function safely in the kitchen. A safety unit would include: the science of food spoilage, (how to detect when food can no longer be safely consumed), reading labels in the kitchen (why you should never mix bleach and ammonia together and what do specific terms like caustic, irritant, fatal, etc. mean), the role natural gas and electricity plays in food preparation, how microwave ovens work and the effect microwave cooking has on specific foods. Lastly I would want my curriculum unit to teach my students that the study of science has a direct impact on their everyday lives and at the same time science can be interesting and fun.

## **Strategies**

## Mini-Unit One

### *The Scientific Method*

The ability to use the scientific method is a real expectation for most high school students. Almost every science text begins and devotes much effort to provide the student with the opportunity to use and practice this procedure. Through the use of concrete, food-based experiences, the scientific method can become real and part of the special needs students' repertoire when performing experiments in science class. The steps of the scientific method are: identify and state the problem, gather information, state a hypothesis, design an experiment, make observations and record data, organize and analyze data, and state a conclusion. There are many food-based experiments that can be used to "walk" the student through the scientific method. For example, students could perform any one of the many experiments found in *Simple Kitchen Experiments* ( M. Mandell). A specific problem could be identified (i.e. why do some people "cry" when they peel onions)? Students could then be asked to do research about the onion (i.e. go to the local supermarket and find out how many different types of onions exists, describe the uses and costs of onions, etc.). Next (with the support of the classroom teacher) students could be asked to form a hypothesis (i.e. people "cry" when peeling onions because something from a cut onion gets into the air that causes people to cry). Students could then be prompted to design an experiment (i.e. think of different ways and conditions that we can cut onions); of course the teacher would be sure to direct the students that one of the ways to cut onions would be doing so under running water. Students then would be directed to make observations (students should encourage to use all of their senses to make the observations) and record data (perhaps this would be an opportunity to teach students how to make a chart). Students would then be asked to analyze the data (using the charts that they made) and hopefully come up with the conclusion that when onions are cut under running water, they don't cry. Depending on the level of the special needs students, the teacher could expound on what really happens when an onion is cut. An activity like this, connects the real world to science in many different ways that takes place outside of the students' classroom. A trip to the supermarket would expose the students to various types of onions (and other vegetables) and increase the students' vocabulary and communication skills.

## Mini-Unit Two

### *Dangers In the Kitchen*

It has been documented that the kitchen is considered by many safety experts to be the most dangerous room in the house. It is important that all students (no matter what their grade level and/or intellectual level) be made aware of potential dangers that are present in the kitchen.

Frances Graham , extension housing specialist from Mississippi State University, outlines in her article "What dangers lurk in your kitchen?", the necessary information that all students should be fully aware of. Ms. Graham feels that the following points need to be made and reinforced: chemicals found in cleansers, pesticides, solvents, and other compounds are a major danger. The directions for the storage, usage and disposal of all chemicals must always be read. Reinforce to the students that they must store chemicals in a proper container out of the reach of children. They (the students) should also take care to measure correct amounts when using any chemical. Many chemicals release gases, and using more than the recommended amount can create dangerous levels. "Inhaling these gases can cause various illnesses and even death," Graham cautions that one should not throw away chemicals. Use them until they are gone, or share them with your neighbors. A good way not to end up with excess chemicals is to buy multi-purpose products and to buy only the amount you need.

It is also important that students understand to keep electrical appliances away from the sink. It is a good idea to have grounded fault circuit interrupters (GFCIs) on all kitchen appliances. GFCIs automatically ground an appliance if in use if it comes in contact with water. Students need to be instructed to never use an oven to warm your house. When buying a new oven, look for one that has control knobs on the top of the range toward the front, so that you won't have to reach over hot burners to regulate cooking temperatures . If an oven has control knobs at the back of the range, be careful not to allow any loose sleeves to come in contact with the burners.

While covering this mini-unit be sure to reinforce that when cooking, keep pot handles turned toward the back of the stove so that hot foods aren't accidentally spilled.

Be sure to inform students that there are other dangers in the kitchen that they need to consider. Some of these considerations may include that knives and other sharp objects should be stored out of the reach of children. Don't use throw rugs or loose carpeting in the kitchen. Mats with a rubber, slip-resistant bottom are the safest. Anything that might cause someone to slip in the kitchen is dangerous.

Small children should not be held or allow to roam freely about the kitchen during food preparation. Just as a science teacher reminds their students about laboratory safety; it is equally important to cover and reinforce the need to be aware of the safety measures that must be taken while working in a kitchen

I would also discuss (and provide activities) that would enable my students to view that danger and usefulness of electricity and natural gas. Activities for this unit could include a scavenger hunt of dangerous chemicals found in cleaning materials that are located in the kitchen and the use of food batteries to demonstrate and discuss how electricity works. These activities could be geared specifically for the grade and/or the intellectual level of the assigned students. It would also be important to develop a specific list of vocabulary words (toxic, flammable, caustic, etc.) that would serve to alert special needs students to specific dangers that are found in the kitchen area. I would also schedule a trip to a local appliance store (community based instruction) and have the students evaluate appliances (especially stoves) for safety and energy efficiency features. I would also want my students construct a chart that list dangers in the kitchen and have them group the dangers according to which specific group will be most impacted by the dangers (i.e. the elderly, children, toddlers, pregnant women, etc.).

### Mini-unit 3

#### *Food Safety*

Food safety is an issue that involves all of us. We want our food to be safe and edible. Students with special needs require direct instruction regarding food spoilage, shelf life, and methods to extend the life of specific food items. One of the most important skills that a student can obtain is the ability to read labels and instructions on food packaging. Students should be able to ascertain when a food item is no longer safe to consume. Many students (especially those with specials needs) will have to be taught to use their senses (sight, smell, touch) and the power of observation to assist them in determining when food may and may not be safe for consumption. Students may also be taught some procedures that may help extend the shelf life of various food items.

Bacteria, yeast, and molds are usually responsible for food spoilage. One of the simplest and most effective ways to help prevent bacterial contamination is by washing ones hands. Students should be frequently reminded of this method that can be quite effective in helping to keep their food supply safe. Students should also be reminded to be alert when eating out; watch and observe the kitchen's staff; observe to see that everyone who handles your food washes their hands (especially after bathroom use). Food can be preserved by destroying certain enzymes or delaying certain chemical processes (such as oxidation). There are specific methods that assist in the preservation of food, they include: refrigeration, freezing, canning, drying, salting and pickling. Chemical additives are also used to prolong the life of certain food items. The USDA (United States Department of Agriculture) describes the specific temperature range (60 degrees to 125 degrees) as a "danger zone" for bacterial growth. Students need to be made aware to be

sure to refrigerate food items that require refrigeration and at the same time make sure that their refrigerators are in good working order. Most students never receive instruction regarding how to clean and maintain their refrigeration units; cleaning coils properly, maintain proper air circulation, etc. are often neglected areas that receive little or no instruction (in either science or home economic classes). Students need to be taught how to freeze and how not to re-freeze specific food items. Many students are unaware that it is not safe to drink milk directly out of a container or bottle; the human mouth contains bacteria that is introduced into items that come into contact with saliva. It is equally important to educate students that when feeding an infant and/or toddler prepared baby food, that the spoon that is placed in the child's mouth, should never be placed back into the baby's food that will be served at a later time. Infants and small children are particularly susceptible to bacterial problems (as they have an immature immune system). Students require instruction regarding the longevity of and proper handling of meat and chicken. Salmonella and trichinosis (and other causes of meat spoilage and contamination) can be eliminated through thorough cooking (students should be taught to use a meat thermometer) and the establishment of strict standards of cleanliness. Techniques of proper storage for all foods should be taught; for example, meat keeps best when it is well wrapped and stored in a cool, dark location. In " Food Preservation and Safety" by Shirley VanGarde and Margy Woodburn, there are some vary basic steps that students could take to ensure safe consumption of food. I would first instruct my students to carefully examine the food. I would tell my students to

look for quality changes such as browning, dryness, rancidity, dissolving, separations, ice crystal damage in frozen foods, and expired dates on commercially manufactured foods. I would also teach my students to look for specific safety changes that may include bacteria, viruses, molds or parasites in food in large enough numbers to overwhelm an individual's immune system. It is important to warn students to always to discard food that has strange odors, visible slime, mold, or any abnormal colors or textures. Students also require instruction regarding how to properly keep hot foods hot and cold foods cold .Be sure to teach students that warm is an unsafe temperature, human pathogens grow extremely well in warm, perishable foods. Food must be stored below 40<sup>o</sup> F or above 140<sup>o</sup>F. This would be an excellent time to review with students what makes a food perishable and what makes a food non-perishable. Supply the students with a long list of foods; have the students divide the list of foods into perishable or non-perishable foods.

When using cooked and raw meat, poultry, milk, eggs and seafood special care must be taken. Reinforce that these foods are naturally contaminated with pathogens. Make sure that students realize that they always need to carefully check BBQ and microwaved foods as they frequently cook unevenly. Heat resistant spores (clostridia and bacillus) are not killed during cooking, so you must store perishable foods properly or they will germinate, grow and cause illness when the food is consumed.

Provide the students with some of the following safety hints: cover and refrigerate leftovers promptly, use smaller containers to store food; large containers can take a long time to cool (and this could create an unsafe environment for your leftovers).

Make sure that the students know that they need to wash their hands and work surfaces well. Wooden cutting boards should not be used with raw foods from animal origin (they are porous and cannot be washed in a dishwasher). Cutting boards, countertops, and other surfaces should be scrubbed with soap and water and rinsed with a bleach-water solution (1 T bleach to 1 gal. of water gives 200 ppm available), chlorine bleach is acceptable for most household use. Don't forget to carefully clean can openers (manual and electric).

It is important that students understand the concept of cross contamination. Cross-contamination occurs when an uncooked animal product touches foods that will be consumed without further cooking. Instruct students that they need to reheat leftovers thoroughly. Heat treatments do not give assurances that an unsafe food is rendered safe, but it does decrease the occurrence of food-borne illness (from *C. perfringens*, *C. botulinum*, and *Listeria*). It is also important that the students comprehend that individuals with a compromised immune system (such as the elderly, the chronically ill, pregnant women and small children) need to take extra precautions when consuming leftovers. It is important to point out to students that they need to observe care labels; care instructions are designed to preserve the quality and prolong the shelf life of non-perishable foods (such as salad dressings). They are often confused with those on perishable foods, which are instructions necessary for food safety. Students need to be taught to distinguish between quality and safety issues involving perishable and non-perishable foods.

#### Mini-Unit 4

##### *Heat and Cooking*

Heat is an extremely important concept in science; it plays a major role in all areas of science (physical, biological and chemical). Heat is a form of energy in moving particles of matter and it can cause chemical reactions. There are three basic ways that heat is transferred: through a solid (conduction), through liquids and gases (convection) and through air (radiation). During food preparation, all three methods of transfer may occur. The study of this unit will begin with basic instruction on what is heat and the effect heat has the movement of particles. This unit affords the teacher the opportunity to instruct students about the various temperature scales (fahrenheit, celsius, and centigrade) and their uses. This unit also provides the student with the opportunity to use thermometers. I would also include the time and opportunity in this unit to discuss and explore what role the calorie plays in food. Students could explore the role heat plays in the use of cooking equipment (pots, pans, crockpots, microwaves, convection ovens, etc.). Students would also have to determine what substances are good conductors of heat and what substances are good insulators of heat. Student may also want to explore the role various substances play in

regard to freezing and boiling points (what effects these phenomena?). A discussion of convection currents could also easily be incorporated into this unit.

## Mini-Unit 5

### *Chemical Reactions*

Chemical reactions are constantly taking place in the laboratory that we call our kitchen. Chemical reactions occur when chemicals combine to form new substances. Bill Nye (the Science Guy) is able to clearly explain what a chemical reaction is on his website (please see works sited page). According to Bill Nye (the science guy), chemical reactions are hard to miss. Explosions, burning, color changes, and gas are all good signs that a chemical reaction is going on. There are also other, less obvious signs that a chemical reaction is going on, they include: changes in temperature, a different smell, or differences in taste. Students could be asked for specific examples of chemical reactions. I would want my students to understand that an everyday occurrence such as baking a cake involves chemical reactions (once a cake is baked, you can't get the original batter back) and that when the state police use a breathalyzer, they are looking for a specific chemical reaction that indicates the presence of alcohol. Since Pennsylvania's first educational standard for science and technology directs teachers to instruct their students so that they (the students) can explain how scientific principles relate to real-world situations, what better way to explain these principles and phenomena than to use the laboratory in our home that we call a kitchen.

### **Classroom Activities**

#### Mini-unit 1 Activity, The Scientific Method

As previously mentioned, all students who study science are required to know and use the scientific method. The scientific method provides both structure and a means for students to examine scientific principles by stating a problem, designing an method to examine the problem and then hopefully relating the problem/solution to real-world situations.

Why Onions Make Us "Cry"?

Begin this experiment with a discussion of onions; ask the students "who has ever eaten an onion"? "Who can tell me the different colors of onions"? "Can anyone name different types of onions"? "What are onions used for"? Allow the students to discuss fully their knowledge of onions. After the students have the opportunity to discuss what they know about onions, pose the following question, "what frequently happens to people's eyes when they cut onions"? Hopefully, at least one student will answer that people cry when they cut onions. Now take a moment to introduce the scientific method. Explain that all scientists use this method when conducting experiments. You may want to discuss why scientists need to conduct experiments and why they need a specific way to gather information, devise a hypothesis, design an experiment, make a hypothesis, do observations, record and analyze data and then come to a conclusion. Explain to the students that now they will use the scientific method to examine why people "cry" while cutting onions and is there a way that onions can be cut so that the "crying" can be eliminated. A lab rubric that can be used to assess student performance during lab procedures has been included in the appendix.

#### Onion Lab Procedure:

Using the teacher-made lab sheet (see appendix) and with the assistance of the students come up with a name for the lab. Next guide the students to state what the problem is ("why do onions make us "cry"?, is there a way to cut onions so that we won't "cry" ?, etc.). Have the students (with teacher guidance) come up with a hypothesis (an onion can or can not be cut without "crying". At this point emphasize that a hypothesis is not a guess, but rather a testable solution to a problem based on knowledge and information that was gathered. Next design an experiment (introduce the concept of a control and an experimental group). Discuss different ways and conditions that onions can be cut (the regular way, holding your nose, under running water, etc.) guide the students to want to try two ways to cut the onion (regular and under running water). Enlist the students' help to come up with a specific procedure (remind them that sequence/order is very important); have the students list the materials that will be needed . Do the experiment, and have the students record their observations. Record, organize and analyze the data (from your observations). Explain to your students that there are different ways to record and organize data; discuss charts, graphs, pictures, etc. Now (with the students' assistance) come up with a conclusion, (when onions are cut under running water, you don't "cry"). Depending on the intellectual level of the students, you may want to go into a detail discussion of the onion's cell structure (if your students can handle it, you may want them to look at an onion cell under a microscope). If your students are able to understand the cell structure of an onion, you may want to explain that when you cut an onion, you tear its cell wall and when that happens a gas (propanethial-sulfur oxide) is released; that gas turns into sulfuric acid when it hits the air. Sulfuric acid stings if it gets into your eyes (and makes you "cry"). When you cut an onion under running water, you dilute the gas before it can get into the air (and into your eyes).

#### *Suggested Related Activities for Special Needs Students*

Take a trip to the local supermarket (community-based instruction) to examine the different types of onions. Discuss colors, shapes, cost and uses. Have a taste test of different types of onions. Discuss the various uses of onions. What happens to onion when it is heated (cooked)?

Why are some onions sweet, sharp, strong, mild, etc.?

You may want to develop a math lesson around the cost of various onions; practice addition and subtraction skills. You may also want the students to learn how to do comparison shopping by checking newspaper ads for onions in local newspapers.

### Mini-Unit 2 Activity, Dangers in the Kitchen Scavenger Hunt

Materials needed:

- Murphy Oil Soap
- Niagra Spay Starch
- Centrum Vitamins
- Bleach
- Soft Scrub Gel
- Dawn Dish Soap
- Ajax Cleanser
- Black Flag Ant and Roach Spray
- Febreze Laundry Aid

Here are the directions that should be given to the students before beginning this activity. Using the list below, match the warnings to the products that are listed above:

1. Intentional misuse by deliberately concentration and inhaling the contents can be harmful or fatal.
2. Avoid accidents keep out of reach of children
3. Caution eye irritant
4. Danger: Corrosive
5. Hazards to humans and domestic animals
6. Warning: Accidental overdose of iron-containing products is a leading cause of fatal poisoning in children under six
7. Will irritate skin. Harmful if swallowed. Do not get in eyes, on skin, or on clothing.
8. Keep out of the reach of children.

9. Caution: Do not puncture or incinerate container. Do not open near flame. Do not freeze, expose to heat or store at temperature above 120<sup>0</sup>F.

Feel free to find other common materials (look in your own home's kitchen) to develop your own materials list.

### *For Specials Needs Students*

Develop a vocabulary and have students define:

Fatal, irritant, incinerate, caution, and corrosive. Have students locate warnings, cautions and hazards on material containers that are found in their own kitchens.

Discuss with students how to properly store dangerous materials and products.

Discuss what the function of the Poison Control Center, Mr. Yuk stickers and what to do in case a harmful/poisonous substance comes in contact (eyes, skin, inhaled or swallowed) with them or someone they know.

### Mini-unit 3 Activity. Food Preservation Lab

Discuss with the students various methods used to preserve foods. Ask students which method of food preservation seems the easiest to do. Lead the student in the direction of food freezing. Assemble a selected number of different (and common) foods. For example I would recommend an uncooked hot dog, lettuce, cottage cheese, and an onion. Place each item in a plastic bag; label and date each bag. After two or three days remove the items from the freezer and observe what has occurred. Which items still look edible; which do not? Now do some brain-storming with the students and try to figure out what has happened. The lettuce probably looks awful (wilted and not very appealing). What is lettuce made up of? Most student will know that lettuce has a high content of water. Discuss what happens to water when it freezes (it expands). Explain that the water in the lettuce has expanded and has burst the plant cells in the lettuce; that caused the lettuce to wilt and look quite unappealing. Next examine the cottage cheese; it has separated and now looks grainy (and very inedible). Cottage cheese also has a high water content, plus it also contains fats (that can separate). The hot dog should look fine; hot dog contain lots of preservative.

Use the lab form (found in the appendix). Allow the students to come to their own conclusions.

### *Suggested Related Activities for Special Needs Students*

A trip to the local supermarket (community-based instruction) would definitely be in order. Students could speak to the managers of the meat department, fish department, and produce department. The students should be encouraged to ask specific questions about spoilage and proper food handling. The students could contact a local food bank to find out where and how they obtain their food items. It would also be appropriate to encourage the students to volunteer at the local food bank(s). Invite a speaker from the county health department. Ask the health department official about how they regulate restaurants and food markets. How do they know when food is spoiled? Ask the officials to discuss the rules, laws and regulations regarding the consumption of food.

#### Mini-unit 4, Heat (calorie) Lab

This is an interesting (and a little more challenging lab for special needs students, depending upon the make-up of your group, this lab could easily be simplified). Students will explore food items of the same mass and determine if they contain a different or a same amount of calories. It is my experience that you will need to make friends with the other science teachers in your building in order to obtain the needed materials for this lab.

Materials needed:

- 10 mL graduated cylinder
- balance (I would recommend a digital balance, but a triple beam balance will also work)
- non-mercury thermometer (10-110°C).
- safety matches
- calorimeter (these can be easily made, you may be able to borrow one from the biology department)
- safety goggles
- food items all weighing the same mass (I prefer walnuts, peanuts, almonds; you could use popcorn, nuts, etc.).

Procedure: Ask the students what they know about calories. I would bring in various food items (canned soup, candy bars, cake mix, etc.); we examine the caloric content (per serving). Then present the food items you have brought in food the lab; ask the students if they believe that items that have the same mass have the same (or different mass). From this discussion and using the lab form (found in the appendix) have the students state a testable problem and also have them form a hypothesis. Using the calorimeter (show the students how to measure the change in the temperature using the water in the test tube located in the calorimeter), note the change in temperature and record the change in water temperature for each food item. Have the students record and organize their data (a chart would work nicely). Now have the students determine whether different types/forms of food items (of the same mass) have a different caloric value. Ask the students which item they would select if they needed the largest amount of energy available from the food items tested.

There are many wonderful labs involving heat; suggested resources have been included in the appendix.

### *Suggested Related Activities For Special Needs Students*

Have students examine various food items and list the calories contained in each serving of that food item. Also have students examine the vitamins contained in each food item. Guide the students to realize that they need to carefully read the nutritional information found on food item packages. Have students examine various pots and pans (perhaps you could bring these items in from home or borrow them from your school's cooking teacher. Have the students determine what type of heat transfer takes place when cooking selected items in a selected pot/pan, etc. (i.e. bacon in a frying pan = conduction, boiling water in a tea kettle = convection, broiling a steak = radiation). You may want to discuss which type of heat transfer is best for a particular type of food item (tough meat stews well, etc.). This would be an excellent time to discuss the pros/cons and safety issues related to microwave cooking. This would be a good time to introduce the use of a meat thermometer and how it is used to check if meat has been properly cooked. You may want practice how to read a thermometer (kitchen, oral, etc.).

### Mini-unit 5 Activity, Chemical Reactions

Materials needed:

- thermometer
- steel wool pads
- vinegar
- glass jar with lid

Procedure: Have the students put the thermometer in a jar and close the lid. Next instruct the students to wait five minutes and write down the temperature. Then have the students remove the thermometer from the jar. Next make sure that the students soak a piece of steel wool in the vinegar for one minute. The next step is to have the students squeeze the vinegar out of the steel wool pad, then wrap the steel wool pad around the bulb of the thermometer. Ask the students to place the thermometer and steel wool back into the jar and close the lid. The last step is to have the students wait five minutes and then take a look at the thermometer. Students should be able to see that the temperature has risen after the steel wool is soaked in vinegar. Try to have the students hypothesize what has happened. What did the vinegar do to the steel wool ? Explain that the vinegar removed any protective coating from the steel wool, allowing the iron in the steel wool to rust. Explain that rusting is the slow combination of iron with oxygen and when that happens, heat energy is released. Remind the students that a change in temperature can indicate that a chemical reaction has taken place. Ask the students if they have ever seen rust anywhere. Get the students involved, let them name various places where they have seen rust. You may want to go into more detail (depending on the intellectual level of your students) as to what

really happens during a chemical reaction. Have the student identify the new substance (rust) that was formed. You may also want them to identify what substances you started out with (the reactants).

### *Suggested Activity For Special Needs Students*

Ask the students if they have ever seen rust before. Ask them where they saw rust.

Try to get the students to explain where they think rust comes from. Discuss what can be done to prevent rust; also discuss what can be done to get rid of rust once it forms. You may also want to expand this activity to explain that when we digest our food chemical reactions takes place within our bodies; these chemical reactions give off heat that keeps our bodies warm. This could lead to a discussion of why we may need to eat more when the weather is cold. The importance of keeping warm, proper methods/ways of staying warm in the winter, etc.

### **Annotated Bibliography / Resources**

Sumrall, William J. "Why Avoid Hands-on Science?" *Science Scope*; v.20 n7 p.16-19 January, 1997

The author of this article who happens to be a professor of science education at Mississippi State University investigates the five most common reasons teachers give for not involving students in hands-on science activities. The author gives some excellent suggestions and time management tools to assist and encourage teachers to use hands-on activities when teaching science.

Mandell, M. *Simple Kitchen Experiments* (1994) Sterling Publishing Company, New York.

This is a very practical (and inexpensive) paperback that is loaded with activities that are fun while at the same time it teaches solid scientific concepts with the use of items found in the kitchen.

Graham, Frances "What dangers lurk in your kitchen"?

<http://msuinfo.ur.msstate.edu/~dur/nycu/nycukit.html>

This article contains much food for thought regarding how to identify and eliminate dangers that are found in the kitchen.

VanGarde, Shirley and Woodburn, Margy "*Food Safety*

*And Preservation: Principles and Practices* (1994)" Iowa State University Press

This book gives the reasons behind specific food safety recommendations.

Nye, Bill *Chemical Reactions* Available: <http://nyelabs.kcts.org/teach/episodeguides/eg24.html>

This site is part of Nyelabs Episode Guides; an excellent resource for teachers who teach science (but have a limited science background).

### Reading List for Teachers

Goodwin, M.T. and Pollen, G. *Creative Food Experiences For Children* (1980) Center For Public Interest, Washington, D.C.

An excellent resource for both regular and special educators that teach science.

There is an excellent chapter on how to have fun with food learning activities.

This book also contains a wealth of nutritional information.

Scott, J.M. *Everyday Science Real- Life Activities* (1988) J. Weston Walch, Portland, Maine.

Contains many varied and interesting activities suitable for elementary, middle and special needs students.

Hillman, H. *Kitchen Science* (1989) Houghton Mifflin, Boston, Massachusetts.

McGee, H. *On Food and Cooking The Science and Lore of the Kitchen* (1984) A Fireside Book, New York.

This book follows a question and answer format that deals with many of the questions we have always wondered about, but never were able to find the answers to. The reading is easy and the material is quite informative.

Weld, Jeffrey D. "Making Science Accessible" *Science Teacher*; v57 n8 p.34-38 Nov 1990 .  
ERIC NO: EJ418948. Feb. 28, 2001.

This article deals with methods that enable teachers to reach students that may be resistant to science and science activities. Contains valuable suggestions on how to use real-world materials and situations to teach scientific concepts.

Nye, Bill *Chemical Reactions* Available: <http://nyelabs.kcts.org/teach/episodeguides/eg24.html>

These guides can be used with or without the popular science tv show that is found on PPS. An excellent resource for teachers with a limited science background.

MadSci Network: Edible/Inedible Experiments Archive.

Food Batteries

<http://www.madsci.org/experiments/achive/889917606.Ch.html> Feb.28, 2001  
MadSci Network: Edible/Inedible Experiments Archive.  
Cabbage Juice- pH indicator

<http://www.madsci.org/experiments/achive/859332497.Ch.html> Feb.28, 2001  
A wonderful lab/activity to help students identify bases and acids.

MadSci Network: Edible/Inedible Experiments Archive.  
Super soap bubbles

<http://www.madsci.org/experiments/archive/854588066> Feb.28, 2001  
An activity every student would enjoy that instructs about surface tension.

Newton's Apple Teacher Guide show #1205

Bread Chemistry

<http://www.pbs.org/ktca/newtons/12/bread.html>  
Explains how and why chemical reactions take place when baking bread. The video is entertaining while providing valuable science instruction.

Reading List for Students

*Plants That Feed Us*, Carol Lane Fenton and Hermine B. Kitchen, John Day and Co., New York  
1971

This contains the story of plants and grains.

*Popcorn*, Millicent E. Selsam, Morrow, 1976  
The entire history of maize is contain in this book.

Edible/Inedible Experiment Archive

[www.madsci.org/experiments](http://www.madsci.org/experiments)  
Students could explore this site to come up with some food activities/labs of their own.

How Things Work

[www.howstuffworks.com](http://www.howstuffworks.com)  
This site explains and provide working models of how everyday objects (like a thermometer) works. The site would be appropriate for all age levels and would work well for students who have difficulty with reading. The site is informative and entertaining.

Materials Needed:

- Mini-unit one
- onion
- sharp knife
- supply/access to running water
- Mini-unit two
- Murphy Oil Soap
- Niagra Spay Starch
- Centrum Vitamins
- bleach
- Soft Scrub Gel
- Dawn Dish Soap
- Ajax Cleanser
- Black Flag Ant and Roach Spray
- Febreeze Laundry Aid
- Mini-unit three
- one head of lettuce
- one cup of cottage cheese
- one hot dog
- one onion
- Mini-unit four
- 10 mL graduated cylinder
- balance (I would recommend a digital balance, but a triple beam balance will also work; a chemistry and/or biology teacher usually can obtain a balance for you)
- non-mercury thermometer (10-110° C).
- safety matches
- calorimeter (these can be easily made, you may be able to borrow one from the biology and/or chemistry department in your school)
- safety goggles
- food items all weighing the same mass (I prefer walnuts, peanuts, almonds; popcorn or any other common foods that will burn easily)
- mini-unit 5
- thermometer
- steel wool pads
- vinegar
- glass jar with lid

## **Appendix**

Lab Rubric

Lab Report Form

## **Lab Rubric**

### **Criteria Excellent Good Needs Work Unacceptable**

Conducts an Has a plan The plan is The plan is lacking The plan is The plan is investigation thorough lacking a few missing major incomplete details details and limited

Uses Materials Manages all Uses materials Mishandles Does not material responsibly most some of the use materials responsibly of the time materials properly

Collects the data Thorough Some of the Major portions The data collection data is of the data are collection of data missing not present contains almost no reliable data

Name \_\_\_\_\_ Date \_\_\_\_\_

Period \_\_\_\_\_ Teacher's name \_\_\_\_\_

## **Lab Report**

Name of  
Lab \_\_\_\_\_

State the  
Problem \_\_\_\_\_

State a Hypothesis \_\_\_\_\_

Design the Experiment:

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Materials Needed:

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Make Observations:

Record, Organize & Analyze Data

Conclusion: \_\_\_\_\_

## **Standards**

As a teacher of students with special needs employed by the Pittsburgh Public School System, I am required to use as a starting point for all of my students (regardless of their disability or academic level of functioning), the standards prescribed for all teachers in the system. Many of my students have disabilities that require adaptations, accommodations and/or specially designed instruction that must be employed when applying the content standards. Specific standards that are addressed in this curriculum unit are listed below and numbered according to the Pittsburgh Public Schools Content Standards.

### Science and Technology

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

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

All students use and master materials, tools and processes of major technologies which are applied in economic and civic life.

All students explain relationships among science, technology and society.

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

All students evaluate the impact on current and future life of the development and use of varied energy forms, natural and synthetic materials, production and processing of food and other agricultural products.

### Communications

All students exchange information orally, including understanding and giving spoken instructions, asking and answering questions appropriately, and promoting effective group communication.

All students communicate appropriately in business, work and other applied situations.

### Mathematics

2. All students compute, measure and estimate to solve theoretical problems, using appropriate tools, including modern technology such as calculators and computers.

6. All students evaluate, infer and draw appropriate conclusions from charts, tables and graphs, showing the relationships between data and real-world situations