Lesson Number: MS.FS.2.2

How to Avoid the Danger Zone

Middle School Food and Agricultural Literacy Curriculum

Precepts

G. Physical Growth

G1. Practice healthy eating habits

National Standards

FPP.01.01.02.b. Discuss the issues of safety and environmental concerns about foods and food processing (e.g., Genetically Modified Organisms, microorganisms, contamination, irradiation).

FPP.02.02.01.a. Describe contamination hazards (physical, chemical and biological) associated with food products and processing.

FPP.02.03.01.a. Explain techniques and procedures for the safe handling of food products.

FPP.02.03.03.a. Describe the effects food-borne pathogens have on food products and humans.

FPP.03.01.02.a Explain the application of chemistry and physics to food science.

FPP.04.03.06.a. Identify and explain storage conditions to preserve product quality.

NL-ENG.K-12.5 – Communication Strategies

NS.5-8.2 – Physical Science

Student Learning Objectives

As a result of this **unit** the student will…

Examine processes involved in food science.

As a result of this **lesson** the student will…

List and describe safe food handling and cooking procedures.

Content Outline

Objective 1. Recognize safe food handling and cooking procedures.

I. Safe food handling and cooking procedures: handling and preparing foods safely to prevent contamination and *food-borne illness*.

Time

Instruction time for this lesson: 45 minutes.

Resources

Iowa State University Extension. (2007). Food Safety Project. Retrieved August 25, 2009, from http://www.extension.iastate.edu/foodsafety/Lesson/L4/L4p1.html — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success. — Seperich, G. J. (2004). Food Science and Safety. Upper Saddle River, NJ: Prentice Hall Interstate.

Tools, Equipment, and Supplies

Overhead projector/transparencies
Bread
Peanut butter
Jelly
Butter knife
Cutting board
Markers, crayons, or colored pencils – one red, green, and yellow for each student; prepare kits ahead of time using small baggies or containers.
MS.FS.2.2.AS.A – one per student
MS.FS.2.2.TM.A – one per teacher
MS.FS.2.2.AS.B.Answer key – one per teacher
MS.FS.2.2.AS.C – one copy cut into cards
MS.FS.2.2.ASSESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in ***bold italics:***

Food-borne illness

FAT TOM

Aerobic

Anaerobic

pH

A. ***FAT TOM***: describes the conditions in which pathogens and ***food-borne illness*** thrive.

1. ***Food-borne illness***: an illness that results from the consumption of improperly prepared or improperly stored foods.

B. F is for Food: Microorganisms need a food source in order to thrive and reproduce.

1. Microorganisms thrive in the foods we eat, including milk, meat, and fish, for example.

C. A is for Acidity: microorganisms thrive in a neutral or slightly acidic ***pH***.

1. ***pH*** measures the level of acidity or alkalinity in a substance.
2. The danger zone for acidity is between 6.6 and 7.5, which is the ideal environment for microorganisms to live.
3. The ***pH*** scale ranges from 0 to 14; acidic foods range from 0 to 6 on the ***pH*** scale, and basic or alkaline foods range from 8 to 14 on the ***pH*** scale; a ***pH*** of 7 is considered neutral.
4. The higher the acidity the lower the ***pH***, and the lower the acidity, the higher the ***pH***.

D. T is for Time: the danger zone for time is two hours.

1. During the two-hour period, microorganisms reproduce very quickly and contaminate the food.
2. If food is unrefrigerated outdoors or at room temperature for two hours or longer, throw it away.

E. T is for Temperature: 40o to 140o F is the danger zone.

1. Keep cold foods cold and hot foods hot.
2. Store cold foods at temperatures less than 40ºF.
3. Store hot foods at temperatures higher than 140oF.
4. Cook foods to internal temperatures ranging from 145o F to 180oF depending on the type of food or meat.

F. O is for Oxygen: some microorganisms need air to grow, and others can grow in conditions without air.

1. ***Aerobic***: oxygen (air) is required for growth.
2. ***Anaerobic***: oxygen (air) is not required for growth; can grow without it.

G. M is for Moisture: microorganisms require a water supply to grow and thrive.

1. Foods like beef jerky, uncooked pasta, or crackers do not have high moisture content and are less susceptible to microorganisms.
2. Foods like bread have higher moisture content and are likely to attract microorganisms, like when bread turns moldy.

H. Other helpful hints to keep foods safe and prevent ***food-borne illness***.

1. Separate cooked and uncooked foods: do not cross contaminate by putting fresh vegetables on a cutting board that was previously used to prepare raw chicken, unless the cutting board is washed with soap and hot water.
2. Wash hands and use utensils when possible: handle foods with clean hands.
3. Marinate in the refrigerator: keep foods cold while they are marinating to maintain a safe ***pH*** and temperature zone.
4. When in doubt, throw it out: if you have the slightest thought a food might not be safe, do not eat it.

Interest Approach

Make a peanut butter and jelly sandwich in an "unsafe" manner by modeling unsafe food handling and cooking methods. Have a cutting board ready for the sandwich, with the ingredients set up and ready to go when class begins. If time permits, allow the bread to get moldy prior to this activity.

We are in store for a lot of fun today but I thought I would make us all a classic snack, a peanut butter and jelly sandwich to keep our energy up.

You know, I was in a hurry this morning when I was grabbing everything to make the sandwiches, and I forgot to wash the cutting board. I used it last night to prepare some raw chicken for my stir fry. Oops, no time to wash it now, so I think we will go ahead and use it anyway. Here we have some bread for our sandwiches, and it looks like there's a little green fuzz here in the corner. Oh well, a little mold never hurt anyone.

Laugh.

Let's get the peanut butter ready to spread onto our bread.

Grab the container of peanut butter and look for the date.

It appears that this peanut butter expired about three months ago. Hmmm, I don't have another jar of peanut butter here, so we will go ahead and use it anyway.

Spread the peanut butter onto the bread.

Time for the jelly!

Grab the jar and read the label.

It says here to refrigerate after opening. I guess I should have read that after I opened it, because this jelly has been sitting in my cupboard for the last two weeks. But again, it's all we have here, so I say we just go ahead and use it. Nothing is going to happen to us, right?

Spread the jelly onto the sandwich.

Super! Looks like our first sandwich is ready to eat, who wants to try it first?

Some students may volunteer to eat the sandwich just because it's funny, and others may not volunteer at all. Based on the response from the class, proceed with the following discussion.

How many of you would actually be willing to eat this sandwich, knowing the bread is moldy, the peanut butter is expired, the cutting board has raw chicken residue on it, and the jelly was not stored properly?

Allow students to raise their hands or verbally respond to your question.

Do you think that eating this sandwich could make you sick?

The correct answer is yes; eating the sandwich would make you sick, but allow students to share their thoughts.

Right! Eating this sandwich has the potential to make you very sick, which is why, today, we are going to be in a food safety zone and learn all about safe food handling and cooking procedures and the ways we can keep our food safe, which would keep us from getting sick.

Summary of Content and Teaching Strategies

Objective 1. List and describe safe food handling and cooking procedures.

Using **MS.FS.2.2.AS.C**, select volunteers to come to the front of the room to teach the class the content on the cards by reading its content out loud. While students are up front teaching the content, the rest of the class will be filling in the blanks on their guided notes, **MS.FS.2.2.AS.A**. After a student shares the content on their cards, they may have a seat and take notes with the rest of the class, starting with the next person to share after they have their turn.

MS.FS.2.2.TM.A should be displayed at the front of the room on the projector while students are sharing so that the information is visible in case the students who are presenting go too fast or students need a little extra time to catch up. In between each presentation, allow the class a minute or two to ensure they captured all of the key information. This will also give the presenters time to fill in the information they may have missed as they were presenting. The guided notes can be collected at the end of class for participation assessment, or you can circulate the room to check the students' notes for completion, which will count as their grade for the day.

As we continue exploring the food industry, it's important to keep in mind that part of practicing healthy eating habits is more than just following the rules of eating a well-balanced diet of the food groups, and maintaining a healthy lifestyle through diet and exercise. Healthy eating habits also include preparing and storing our food properly to avoid ***food-borne illness***.

Today we are going to learn about those specific guidelines that will help us improve our safe handling practices and cooking methods. For this activity, you will be put up to the challenge of being detailed note-takers and intent listeners. Do you think you can do it?

Motivate students by getting them to agree that they can do it.

Great! Some of you will get the opportunity to be the teacher today.

When I say SAFETY, I am going to select eight volunteers to come to the front of the room to take turns teaching the class today's content. The cards will be numbered so you must pay attention so you know when it is your turn to present. Feel free to use exciting or dramatic voices to make your presentations more exciting and write key terms on the board.

Remember, you are the teachers! When you are not up here teaching, you will be taking guided notes using the outlines I am going to pass out in just a moment. What questions are there?

Pause.

Awesome!

Proceed to select volunteers and begin the activity.

SAFETY! That means I need eight volunteers to help be teachers today.

Select eight students who are willing to present. While you are selecting students, ask another student to pass out the guided notes handout. Once everyone has a handout and volunteers have been selected, each student will take turns and come to the front of the room to share the content with the class.

Review/Summary

Use the Crayon e-Moment® to review the content for this lesson. Each student should receive a kit containing red, yellow, and green colored pencils, crayons, or markers. Red will signify concepts they do not understand. Yellow will signify concepts they are unsure of, meaning there are parts they do not understand or questions they have regarding that piece of content. Green will signify concepts they feel confident about and fully understand.

Students will use this system to assess their guided notes and determine what they understand, are confused about, or do not understand by circling, highlighting, underlining, or marking in some way those pieces of content. As you review the students' guided notes for completion, you will be able to determine student progress and comprehension through this system, which will help you determine if it is necessary to teach the content in further detail. Everything should have a color on it after the completing this activity.

Great job teaching and taking notes today! It is obvious to me that no challenge is too difficult for you! The next step of this activity is to assess what we have just learned about the safe handling of food and safe cooking procedures.

In just a moment, a volunteer and I are going to pass out kits containing red, yellow, and green crayons/colored pencils/markers. Your next mission is to circle, highlight, underline, or color-code in some way, the information you learned that you either did not understand using red, sort of understand but maybe have some questions about using yellow, and completely understand and/or found interesting using green.

So, quick recap: red is do not understand, yellow is sort of understand/still have questions, and green is completely understand or found interesting. I will know you are finished when the coloring tools are back in the kits and your papers are flipped over. You will have the remainder of the class period to complete this task. What questions are there?

Pause.

Great! May I have a volunteer help me pass out the kits?

Select a student to help pass out kits. Be sure to circulate around the room to assess the guided notes for completion and participation. Collect the guided notes when students are finished to review their color codes, but be sure to give them back to the students the next class. Also, end about five minutes early depending on how much time was left when you started this activity to allow for clean up before the next class.

Application

Extended classroom Activity:

FAT TOM Mobiles: Students will make mobiles about ***FAT TOM*** and safe food handling and cooking procedure. Each piece of the mobile will contain a piece of information explaining ***FAT TOM***. Hang the mobiles around the room for display.

Another suggestion is if you have the time and/or resources, create a food safety podcast.

FFA Activity:

Schoolwide Food Safety Campaign: FFA members will design a series of bulletin board displays to be placed around the school campus as part of an FFA chapter meeting activity. The bulletin boards should promote safe food handling and cooking practices as an effort to inform the school community about food safety.

SAE Activity:

Cooking Safe: Students will cook a meal either on their own or with the help of their parents and create a poster including the recipe for what they prepared, the steps in the cooking process, and the specific safe food handling procedures they followed to prepare the food. The poster can also include pictures of the students while they are cooking the food to show the steps they took in the process. Students will present the posters to the class. To go along with the food safety campaign, the posters can be displayed in the school cafeteria, in the media center, or around the classroom for others to see.

Evaluation

MS.FS.2.2.ASSESS.A

Answers to Evaluation

Guided Notes: Review the guided notes for completion, if all blanks are filled in, then assess the color codes to determine student learning progress.

1. A
2. A
3. B
4. C
5. A

Food Safety Guided Notes

Name_____

1. Safe food handling and cooking procedures prevent contamination and _____.
2. Food-borne illness is the result of eating foods that were improperly _____ or _____
3. F is for _____. Microorganisms need to eat too; they need a source like _____ or eggs to grow and reproduce.
4. A is for _____. The danger zone is between _____ on the _____ scale.
5. T is for _____. The danger zone is _____.
6. is for _____. The danger zone is between _____. Keep cold foods cold and hot foods hot!
7. O is for _____. _____ microorganisms need oxygen to grow and reproduce. _____ microorganisms can grow and reproduce without oxygen.
8. M is for _____. Microorganisms need a _____ in order to grow and reproduce.
9. Separate cooked and uncooked foods. Do not _____.
10. _____ and use utensils when possible.
11. _____ in the refrigerator, it's safer!
12. When in doubt, _____!

Objective 1. Recognize safe food handling and cooking procedures.

I. Safe food handling and cooking procedures: handling and preparing foods safely to prevent contamination and food-borne illness.

A. ***FAT TOM:*** describes the conditions in which pathogens and ***food-borne illness*** thrive.

1. ***Food-borne illness:*** an illness that results from the consumption of improperly prepared or improperly stored foods.

B. F is for Food: Microorganisms need a food source in order to thrive and reproduce.

1. Microorganisms thrive in the foods we eat, including milk, meat, and fish, for example.

C. A is for Acidity: microorganisms thrive in a neutral or slightly acidic ***pH***.

1. ***pH*** measures the level of acidity or alkalinity in a substance.
2. The danger zone for acidity is between 6.6 and 7.5, which is the ideal environment for microorganisms to live.
3. The ***pH*** scale ranges from 0 to 14; acidic foods range from 0 to 6 on the ***pH*** scale, and basic or alkaline foods range from 8 to 14 on the ***pH*** scale; a ***pH*** of 7 is considered neutral.
4. The higher the acidity the lower the ***pH***, and the lower the acidity, the higher the ***pH***.

D. T is for Time: the danger zone for time is two hours.

1. During the two-hour period, microorganisms reproduce very quickly and contaminate the food.
2. If food is unrefrigerated outdoors or at room temperature for two hours or longer, throw it away.

E. T is for Temperature: 40° to 140° F is the danger zone.

1. Keep cold foods cold and hot foods hot.
2. Store cold foods at temperatures less than 40°F.
3. Store hot foods at temperatures higher than 140°F.
4. Cook foods to internal temperatures ranging from 145° F to 180°F depending on the type of food or meat.

F. O is for Oxygen: some microorganisms need air to grow, and others can grow in conditions without air.

1. ***Aerobic:*** oxygen (air) is required for growth.
2. ***Anaerobic:*** oxygen (air) is not required for growth; can grow without it.

G. M is for Moisture: microorganisms require a water supply to grow and thrive.

1. Foods like beef jerky, uncooked pasta, or crackers do not have a high moisture content and are less susceptible to microorganisms.
2. Foods like bread have a higher moisture content and are likely to attract microorganisms, like when bread turns moldy.

H. Other helpful hints to keep foods safe and prevent food-borne illness.

1. Separate cooked and uncooked foods: do not cross contaminate by putting fresh vegetables on a cutting board that was previously used to prepare raw chicken, unless the cutting board is washed with soap and hot water.
2. Wash hands and use utensils when possible: handle foods with clean hands.
3. Marinate in the refrigerator: keep foods cold while they are marinating to maintain a safe ***pH*** and temperature zone.
4. When in doubt, throw it out: if you have the slightest thought a food might not be safe, do not eat it.

Food Safety Guided Notes

Name_____

Date _____

1. **Safe food handling and cooking procedures prevent contamination and food-borneillness.**
2. **Food-borne illness is the result of eating foods that were improperly prepared or stored.**
3. **F is for food. Microorganisms need to eat too; they need a source like meat or eggs to grow and reproduce.**
4. **A is for acidity. The danger zone is between 6.6 and 7.5 on the pH scale.**
5. **T is for time. The danger zone is two hours.**
6. **T is for temperature. The danger zone is between 40o and 140o F. Keep cold foods cold and hot foods hot!**
7. **O is for oxygen. Aerobic microorganisms need oxygen to grow and reproduce. Anaerobic microorganisms can grow and reproduce without oxygen.**
8. **M is for moisture. Microorganisms need a water supply in order to grow and reproduce.**
9. **Separate cooked and uncooked foods. Do not cross contaminate.**
10. **Wash hands and use utensils when possible.**
11. **Marinate in the refrigerator; it's safer!**
12. **When in doubt, throw it out!**

Food Safety Cards

1. Safe food handling and cooking procedures means that when we handle or prepare foods safely, it will lead to the prevention of contamination and food-borne illness. Today we are going to meet ***FAT TOM***, and he is going to tell us about the conditions in which pathogens and ***food-borne illness*** thrive.

If you aren't familiar with the term ***food-borne illness***, it means an illness that results from the consumption of improperly prepared or improperly stored foods.

2. F is for Food. Microorganisms need a food source in order to grow and reproduce. Microorganisms thrive in the foods we eat, including milk, meat, and fish, for example. A is for Acidity. Microorganisms thrive in a neutral or slightly acidic ***pH***. The ***pH*** measures the level of acidity or alkalinity in a substance.

3. The danger zone for acidity is between 6.6 and 7.5, which is the ideal environment for microorganisms to live. In case you are not familiar or need some help to remember, the ***pH*** scale ranges from 0 to 14; (draw a horizontal line with 14 hash marks intersecting the horizontal line; then label each mark 1-14); acidic foods range from 0 to 6 on the ***pH*** scale and basic or alkaline foods range from 8 to 14 on the ***pH*** scale; a ***pH*** of 7 is considered neutral. The higher the acidity the lower the ***pH***, and the lower the acidity, the higher the ***pH***.

4. T is for Time. The danger zone for time is two hours. During the two-hour period, microorganisms reproduce very quickly and can contaminate the food. If food is unrefrigerated outdoors or at room temperature for two hours or longer, throw it away.

5. T is for Temperature. 40° to 140° F is the danger zone. Keep cold foods cold and hot foods hot. Store cold foods at temperatures less than 40°F. Store hot foods at temperatures higher than 140°F.Cook foods to internal temperatures ranging from 145°F to 180°F depending on the type of food or meat.

6. O is for Oxygen. Some microorganisms need air to grow, and others can grow in conditions without air. ***Aerobic*** microorganisms require oxygen (air) for growth. ***Anaerobic*** microorganisms do not require oxygen (air) for growth, which means they can grow without it.

7. M is for Moisture. Microorganisms require a water supply to grow and reproduce. Foods like beef jerky, uncooked pasta, and crackers do not have high moisture content and are less susceptible to microorganisms. Foods like bread have a higher moisture content and are likely to attract microorganisms, like when bread turns moldy.

8. Other helpful hints to keep foods safe and prevent food-borne illness include the following: Separate cooked and uncooked foods; do not cross contaminate by putting fresh vegetables on a cutting board that was previously used to chop raw chicken, unless the cutting board is washed with soap and hot water. Wash hands and use utensils when possible: handle foods with clean hands.

9. Marinate in the refrigerator: keep foods cold while they are marinating to maintain a safe ***pH*** and temperature zone. When in doubt, throw it out: if you have the slightest thought a food might not be safe, do not eat it. If you keep these rules in mind and cook and store foods properly, you will be able to avoid the danger zone.

Name _____

Directions: Read each statement and decide which response is appropriate by circling the correct letter that corresponds with the selected response, or by writing the response in the space provided.

1. **Food-borne illness is the result of consuming improperly stored or prepared foods.**
   A. True
   B. False

2. **The danger zone rule for time and temperature is _____ hours.**
   A. Two
   B. Three
   C. Four
   D. Five

3. **Anaerobic microorganisms require oxygen to grow and reproduce.**
   A. True
   B. False

4. **Microorganisms thrive in foods with a _____ level between 6.6 and 7.5.**
   A. Temperature
   B. Acidity
   C. pH
   D. None of the above

5. **The danger zone for cooking various foods ranges between 40o F to 140oF.**
   A. True
   B. False