**Hands on experience in food safety for high school**

These exercises are based on two rules of food safety at food service establishments:

A. **FAT TOM: Food, Acidity, Time, Temperature, Oxygen and Moisture**
B. **Four basic steps to food safety (Clean, Separate, Cook, and Chill)**

In this exercise students will learn the required conditions for the growth of microbes and the basic steps used in the kitchen to keep the food safe.

**FAT TOM:**

Students can work to determine how these factors can affect food safety.

1. **Food:**

We explain the effect of food components on the microbial growth. Students will understand that protein-rich foods that can promote the growth of microorganisms

Students will have the opportunity to discuss different food products (usually milk, cheese, yogurt, meet, cereal, and canned food in addition to other commodities) then students need to determine which food can promote the growth of microorganisms.


In this exercise; we usually have food samples on site, we discuss breakfast meals, nutrition facts, etc… food composition). Students are usually engaged in this activities and discuss components in food that promote the growth of microorganisms.

2. **Acidity:**

   Students can measure the pH of different type of foods and determine which one can promote the growth of foodborne pathogens.

   Students can also standardize the pH meter using pH 4, pH 7 and pH 9 buffers.

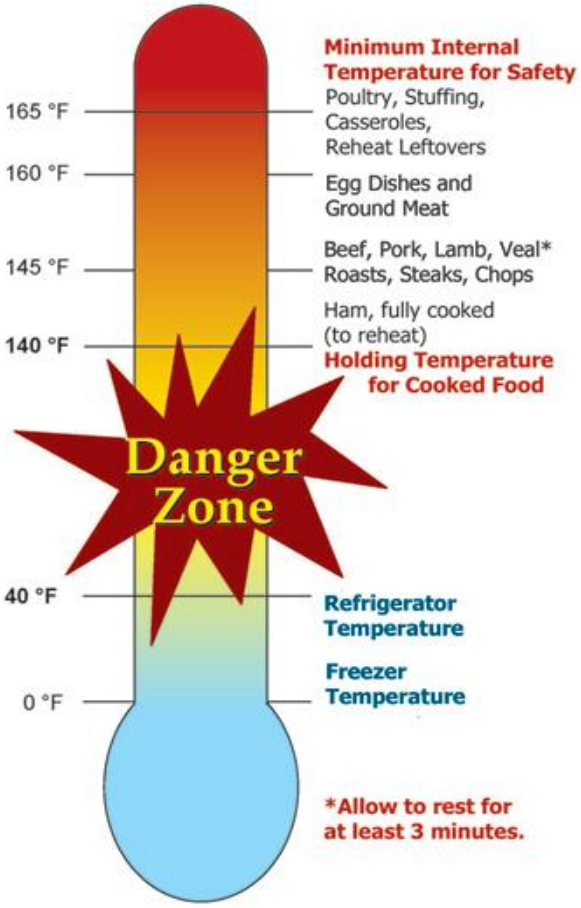
   Student will understand the important of pH in food safety and will be asked to group different food products based on acidity according to the figure below.

| pH4 | | | pH7 | | | pH10 |
|---|---|---|---|---|---|---|
| Strong Acids | | Mild Acids | | Mild Alkaline | | Strong Alkaline |
|  White Bread | |  Meat/Fish | |  Fruits | |  Asparagus |
|  Alcohol | |  Legumes | |  Vegetables | |  Cayenne Pepper |
|  Colas/Sodas | |  Nuts | |  Avocados | |  Melons |
|  Sugar | |  Dairy | |  Almonds | |  Kelp |

### 3. Time

Students will understand that bacteria required time and temperature to grow. Students will understand the concept of Danger Zone and that food cannot stay in the danger zone temperature for more than two hours, either by cooling or heating. While most guidelines state two hours, a few indicate four hours is still safe according to different type of food.

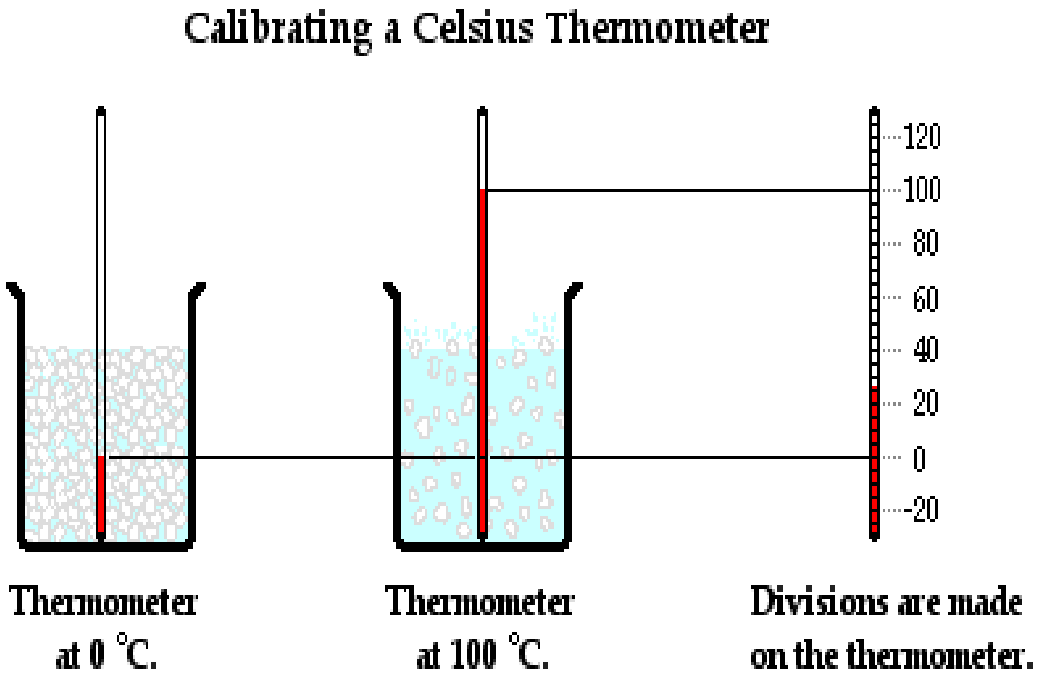
Cooling and heating are usually used to control the temperature of food. Students will determine the appropriate use of heating and cooling to ensure the safety of food. Example of foods used for this exercise: salad, dressing, fried chicken, pizza, milk, boiled eggs, etc.



4. **Temperature**

Students can use thermometer to measure the temperature of different Foods such as warm food (above Dangerous Zone), food in the dangerous zone temperature, and cooled food (Below 40˚F)

Students can also calibrate the thermometer using Ice bath and boiling water




5. **Oxygen**

Student can determine which food is exposed to oxygen and the effect of oxygen on microbial growth.



## 6. Moisture

Students can measure the moisture of different food products and determine which food can support the growth of foodborne pathogens.



**Four basic steps to food safety**

This exercise takes few hours to complete as students are usually involved in the procedure. We take prepared agar plate and peptone water solution to the school. We allow students to practice traditional microbiological analysis using dilution and plate count. Students will prepare the samples, dilute the samples, and surface plate the samples on the agar plates. The plates will then be taken to our laboratory and incubated at 37˚C for 24 h. The results are shared with the students next day, we usually email photos of the plates or Skype with the students.

1. **Clean:**

We test several biological and environmental samples (pasteurized milk, yogurt, ground beef, green leafy vegetables, water, soil, ..etc.) for microbiological quality (total count). We used both non selective and selective agar media.

We explain the importance of cleaning process and the use of sanitizers in food safety. Students will use different sanitizers to clean utensils and cooking area then will take a swab samples from clean and unclean surfaces to determine the total microbial count.

2. **Separate:**

We usually use different cutting board (wood, plastic..etc) and determine the microbial presence, then we clean and conduct another analysis.

Students will conduct the separation process as follow:

a. Cut meat and salad using the same cutting board and knife.
b. Cut meat and salad using different cutting board and knife
c. Take samples of salad prepared in a and b
d. Mix salad samples with peptone water
e. Dilute the samples using peptone water
f. Surface plate the appropriate dilutions onto agar plate

3. **Cook:**

Students will determine the bacterial count of raw, undercooked and full cooked meat as follow:

a. Students take raw meat samples and divide into three samples, first sample will remain raw, second sample will be undercooked, and third sample will be cooked to proper temperature.
b. Students will mix the samples with peptone water
c. Dilute the samples using peptone water
d. Surface plate the appropriate dilutions onto agar plate

4. **Chill:**

Students will cook meat then cool it to refrigerating temperature for storage.

a. Cooked ground meat will be cooled down using proper cooling method
b. Cooked ground meat will be cooled down by leaving the meat at room temperature
e. Students will mix the samples with peptone water
f. Dilute the samples using peptone water
g. Surface plate the appropriate dilutions onto agar plate