# Math-in-CTE Lesson Plan

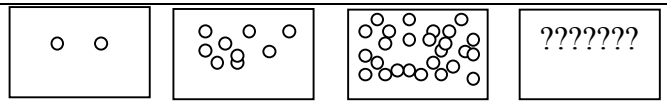
| | | |
|---|---|---|
| *Lesson Title:* | **Safety and Sanitation** | Lesson 01 |
| *Occupational Area:* | Culinary Arts | |
| *CTE Concept(s):* | Safety and Sanitation | |
| *Math Concepts:* | Tables, graphs, growth rate (exponential notation), and patterns | |
| *Lesson Objective:* | Students will be able to compare bacterial growth at different temperatures by using graphs | |
| *Supplies Needed:* | Bacterial growth rate chart, graph paper, ruler, various colored pencils | |

| THE "7 ELEMENTS" | TEACHER NOTES (and answer key) |
|---|---|
| **1. Introduce the CTE lesson.**<br>Safety and Sanitation is greatly concerned with controlling bacterial growth in food. Bacteria increases at a rapid rate, it is not a constant, but instead is referred to as exponential growth (Talk about exponential growth). As food service professionals, we control bacteria through the use of temperature and time.<br>Have you ever pulled something out of the fridge and it just didn't smell right? How old was it? How do you know?<br>If we were going to track bacterial growth how could we best show this?<br>How do you think different temperatures will affect its growth? | http//www.cellsalive.com/ecoli.htm - a website that illustrates bacterial growth.<br>See page 5.4 ServSafe |

| | |
|---|---|
| **2. Assess students' math awareness as it relates to the CTE lesson.**<br>1. What do chilling, freezing and heating do to bacteria? | 1. Chilling and freezing slow down the growth of bacteria, heating kills the bacteria. |
| 2. What is an exponent? | 2. *When we talk about exponential growth, and how fast something grows, how do you think that looks mathematically? What word do you think of in mathematics? Then ask, what is an exponent? What does it look like? Can someone give me an example? How would we solve this? Give multiple examples using various exponents and ask students to identify the exponent and the base: $3^2$ = 3•3 = 9, $4^3$ = 4•4•4 = 64, $2^5$ = 2•2•2•2•2 = 32. An exponent tells how many times the base is used as a factor. |
| 3. What is a graph? | 3. A pictorial representation of some mathematical relationship. |
| 4. Name some components of a graph? | 4. The *x* axis (horizontal line), the *y* axis (vertical line), forming a right angle. Coordinate pairs which are an ordered pair of numbers that locates a point on the coordinate plane with reference to the *x*- and *y*-axes. We use the lines to represent different related values, plot the coordinates on the graph and draw a line through them to represent the changes. |
| | 5. A growth rate that does not change, on a graph it is represented as a straight line. |

5. What is constant growth or linear growth?

6. Lets go back to talk about exponential growth, what do you think that looks like. What if we drew pictures?

6. 


1 hrs. 2 hrs. 3 hrs. 4 hrs.

Base – The number which is to be raised to a given power
Power – A number raised to a power

**3. Work through the math example *embedded* in the CTE lesson.**

Using the table of values related to bacteria growth rates we will plot the growth of bacteria at body temperature.

At optimal temperature (98.6°F) Salmonella bacteria cells multiply by two every twenty minutes. Let us graph their growth for 2 hours.

However, Salmonella will not grow at temperatures below 44°F*;* most refrigerators are set at 38°F, and therefore salmonella does not grow at all in refrigeration. So why does chicken eventually spoil? Through the law of decay (putrefaction).

ServSafe pg. 2.11

| Temperature | Generation Time |
|---|---|
| 40°*f.* | No growth |
| 45°*f.* | 12 h. |
| 72°*f.* | 65 m. |
| **98.6°*f.*** | **20 m.** |
| 108°*f.* | 24 m. |

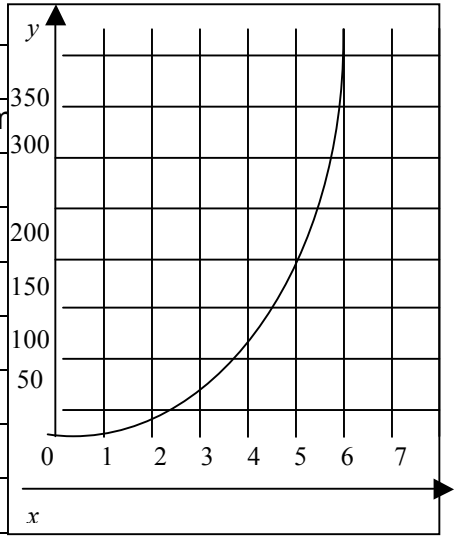
**4. Work through *related, contextual* math-in-CTE examples.**

Have students graph the growth rate of bacteria at 45°*f*. for 72 hours.

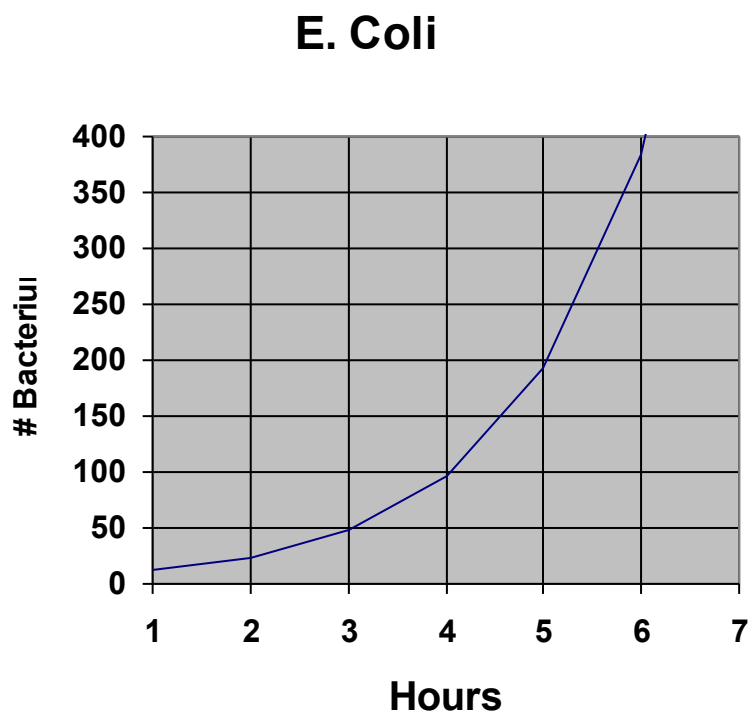
Napkin folding exercise: using a napkin illustrate how many holes it has (zero). Fold the napkin two times (in fourths) and cut the corner with scissors. Unfold and show how many

Bacterial growth rate chart, graph paper, ruler, various colored pencils.

Napkin folding: Napkins, scissors, paper, pencil and graph paper.

<table>
<tr><td>holes there are. Record the values on a table. Continue folding, cutting, counting and recording as you go. Graph your results.</td><td></td></tr>
<tr><td>5. Work through traditional math examples.<br><br>Assign worksheet, review sheet with students to check for understanding, allow students for time to work the problems. Go through the answers with the students on the board.</td><td>See attached practice worksheet.<br><br>See answer key worksheet</td></tr>
<tr><td>6. Students demonstrate their understanding.<br><br>Students will do a worksheet for homework</td><td>See attached homework assignment and answer key</td></tr>
<tr><td>7. Formal assessment.<br><br>On a test, provide a math problem to assess understanding.<br><br>Example: You are slicing ham on your shift, get distracted and forget to place it back in the refrigerator. The ham is at room temperature for six hours and originally had 6 cells of e. Coli that had been cross-contaminated from some ground beef. The e. Coli bacterium grows at a fast rate, doubling every 60 minutes at room temperature. Graph how many bacterium you will have at the end of the six hours, when you finally remember that you left it out. What should you do with the ham?<br><br>$6(2^6)=384$</td><td>Throw it away!<br><br>
<table>
<tr><td>e. Coli</td><td></td></tr>
<tr><td>Hour</td><td># of bacterium</td></tr>
<tr><td>x</td><td>y</td></tr>
<tr><td>1</td><td>(12)</td></tr>
<tr><td>2</td><td>(24)</td></tr>
<tr><td>3</td><td>(48)</td></tr>
<tr><td>4</td><td>(96)</td></tr>
<tr><td>5</td><td>(192)</td></tr>
<tr><td>6</td><td>(384)</td></tr>
</table>


</td></tr>
</table>


E. Coli
400
350
300
250
200
150
100
50
0
# Bacteriul
1
2
3
4
5
6
7
Hours

NOTES: