

CHEMICAL ENGINEERING AND MANUFACTURING

CHEMICAL ENGINEERING

Objective

Chemical Engineers are involved in the production of food, cosmetics, fuels, and anything else that requires the mixing of chemicals. This lesson introduces students to one component of chemical engineering: food processing.

Learning Outcomes

Students will learn:

1. The difference between a food scientist, a chemist, and a chemical engineer
2. How chemical engineers are involved in food production
3. That chemical engineers need math to change a simple chemical equation or recipe into mass production

Essential Questions

1. How do they make 4 billion Pop Tarts in a year?
2. Why do Fruit Loops taste the same no matter where you are?
3. How are chemical engineers involved with food processing?

Time Required (Itemized)

1. Introduction to Chemical Engineering and activity (20 minutes)
2. Assembly line preparation and competition (30 minutes)
3. Judging of final products (10 minutes)

Assessments

Students may be graded on participation, leadership, completion, attention to detail, etc.

Materials

1. Cookies
2. Frosting
3. Food coloring
4. Sprinkles
5. Butcher paper
6. Knives
7. Spoons
8. Cups
9. Paper towels
10. Markers

Lesson Description

Chemical Engineers are responsible for the mass production of many things. They make it so foods taste the same no matter where you are in the world. At Kellogg's, for example, Chemical Engineers work on the filling of Pop Tarts, the pastry, and the frosting.

Questions to ask students:

1. What are the differences in the chemical properties between cake frosting found in a canister and pop tart frosting?
2. Does pop tart frosting burn when you put it in the toaster? Why/Why not?
(Answer: it doesn't burn before the pastry)
3. What would happen if you frosted a pop tart with cake frosting?

If we take a look at the frozen California Pizza Kitchen Pizzas in the freezer section of the grocery store, we can talk about the process. The head chef of California Pizza Kitchen creates a Barbecue Chicken Pizza, then the chef passes the recipe over to the Chemical Engineer to make thousands of the same pizza.

Questions to ask students:

1. How can you take a recipe for one pizza, and increase it to make 50,000 of the exact same pizza? (Answer: chemistry, chemical equations, math, etc.)

There is a branch of Chemical Engineering called Process Engineering. The role of Process Engineers is to create the process used to make things with chemicals on a large scale. This applies to all production: crude oil separation, food processing, cosmetic manufacturing, etc.

Now that students have a background on Chemical Engineers, it is time for the activity. Separate the students into two groups. Each team will work against each other to see who can prepare all of their cookies in the fastest amount of time. The trick is that the cookies need to be uniform, so it's not all about speed.

Procedure:

1. Ask all students to wash their hands and to avoid touching faces, hair, etc.
2. The tables are lined with butcher paper
3. Markers are placed on the tables to determine where the stations will be located
4. Suggested stations
 - a. Cookie start spot
 - b. Cookie finish spot
 - c. Color mixing
 - d. Blue frosting
 - e. Green frosting
 - f. Pink frosting
 - g. Purple frosting
 - h. Sprinkle sorting
 - i. Sprinkle placement
 - j. Quality control
5. Students will be given 5 minutes to determine where each station will be placed, and then they will mark it on the paper
6. After each of the stations is created, the timer will begin and the teams will work to decorate their 25 cookies
7. Suggested cookie design
 - a. Pink frosting base
 - b. 3 horizontal purple lines

- c. 3 vertical blue lines
 - d. 1 green spiral
 - e. Sprinkles on top (extract all brown sprinkles—for added complication)
8. Each team will be timed separately
 9. After each team has finished, the judging will begin
 10. Teams will be judged on uniformity and efficiency
 11. One point will be taken away for: each brown sprinkle found on the cookies, messed up lines, etc.

Conclusion

Wrap up the activity by asking the students if the process was easy or hard. Ask them to share their thoughts about the process. Reiterate the process involved with creating the final product.