

I Can Statements

Yeast and Baking - I can develop and analyze from experiments and use this for a desired outcome.

Gluten - I can examine models and predict chemical properties on a large scale based on those models.

Bakers Math - I can convert measurements through dimensional analysis.

The Chemistry of Bread

Write Name Here

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Bread Baking

Bread baking has been around for 1000s of years. Baking bread, in its simplest form, requires a few simple ingredients and equipment.

Bread baking has changed as the planet's population has increased. Scientists have examined each chemical and step of the bread baking process. Can we use science to help a chemical process taste good, cost little and become more efficient? How can we effectively make the best bread possible with the least amount of time and money? That is our goal.

Along the way, you will have two options. Option A is the "no bake" option. Option B is the "bake" option. You get to pick!

Watch this Intro to Bread



How This is Going to Work

We will work through each process of the bread baking experience. Here is what will help you in the process.

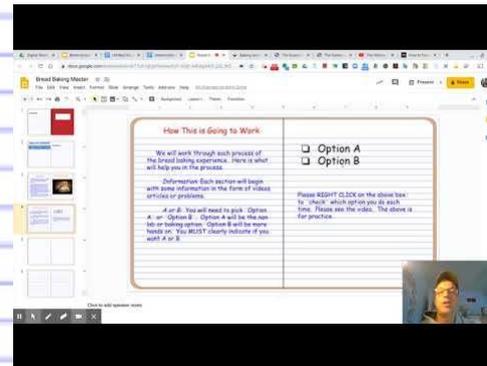
Information: Each section will begin with some information in the form of videos, articles or problems.

A or B: You will need to pick "Option A" or "Option B". Option A will be the non lab or baking option. Option B will be more hands on. You **MUST** clearly indicate if you want A or B.

Option A

Option B

Please **RIGHT CLICK** on the above box to "check" which option you do each time. Please see the video. The above is for practice.



Yeast

Ingredient #1 - Yeast

Yeast is a living organism that is essential for bread baking. Yeast reacts with sugar to create a gas, carbon dioxide, and an alcohol. This process is called "fermentation". If an alcohol is produced, how is it that we do not get drunk when we eat bread? The alcohol has few interparticle forces and it evaporates during the baking process. The gas is the important part. The gas gets trapped in the dough and makes the bread "rise".

❑ Option A

❑ Option B



Option A - Research the difference between "Active Yeast" and "Rapid Rise" yeast.

Option B - Do an experiment and prove the difference between "Active Yeast" and "Rapid Rise" yeast.

Yeast - Option A

Purpose - Determine if the difference between Active Dry or Instant Rise yeast.

Read the following article. [YEAST LINK](#)
Answer the questions by typing in the gray boxes.

1. Of the three types of yeast, which is the best to use? What is a disadvantage to using it?

2. Why must dry yeast be first put in water or "proofed" before using?

3. What is the biggest difference between "instant" and "active" yeast? What is it about the process that makes "instant" yeast different than "active yeast"?

4. Suppose a recipe calls for "Active Yeast" but you only have "Instant Rise" yeast. How much percentage more or less should you use??

Yeast - Option B-The Experiment

Purpose - To determine the difference between "Active Dry" and "Instant Rise" or "Rapid Rise" yeast (Rapid Rise and Instant Rise are the same).

Materials- 2 one liter bottles, 2 balloons (same size), Teaspoon for measuring, 1 measuring cup, warm water, 6 teaspoons of sugar, funnel, 1 packet of Active Dry yeast, 1 packet of Rapid Rise yeast.

Procedure

1. Place 8 ounces (1 cup) of warm water in each 1 liter bottle. If you place your hand underneath the water and it is so hot that you need to pull your hand out, this is warm enough.
2. Label one bottle "Active Dry" and the other bottle "Rapid Rise" yeast.
3. Add the packets of yeast to the respective bottles.
4. Add 3 tsp of sugar to each bottle.
5. Cap and shake.

6. Uncap the bottles.
7. Place the balloons on top so that no gas can escape.
8. Record what happens over several hours.



You may use your camera on your phone to record data.

Please fill out this form and answer questions about your experiment:

[Link To Form](#)

Flour and Gluten

The next two ingredients are water and flour. What is H_2O which is a polar molecule. Flour contains two important proteins that make up "gluten". Proteins are long covalently chains of amino acids. Amino acids are covalently bonded compounds that are contain nitrogen and are also polar. Remember that anything with OH groups and NH groups form hydrogen bonds. This is a strong form of interparticle forces. Mixing water with long strands of proteins that hydrogen bond and interconnect starts to form a "netting" that is so tight and strong that it can capture the gas that is a product of fermentation. This is what helps make the bread rise.

- ❑ **Gluten Option A**
- ❑ **Gluten Option B**



❑ Gluten Option A

1. Click on the link.
2. Read the article from CHEMMATTERS about bread and gluten.
[LINK TO ARTICLE](#)
3. After reading the article, answer these questions.

[LINK TO THE FORM TO ANSWER THE QUESTIONS](#)

All about Gluten



❑ Gluten Option B

Purpose: Determine the effect of gluten on flour and bread.

Materials: Spoons, bowls, measuring cups, water, 2 different types of flour. Sample A could be "Bread Flour" or "All Purpose Flour" (more gluten). Sample B could be "Whole Wheat Flour", "Cake Flour" or "Non Gluten Flour" (less gluten)

Procedure:

1. Measure one cup of a type of flour and pour into bowl.
2. Add a half of a cup of water.
3. Mix with spoon.
4. Knead for 10 minutes. You can do this with spoon. If you do it with hands you can add a little flour to the surface or hands so it will not stick.
5. Make into a ball and set aside for 10 minutes.
6. Repeat with second sample of flour.

7. Place one of the samples in a strainer.
8. Run under cold water and mix with hands.
9. Turn off water once the water is running clear.
10. Repeat with second sample.
11. Record observations in linked form below.

[Response Form Link](#)

*Note - If you do not have all of the materials, you can alter the experiment. The important part is to keep a 2:1 ratio of flour to water.

Option A and B - Baker's Math

Cooks must convert measurements all of the time. It is no different in bread making. Here are some examples.

If a recipe calls for Active Dry yeast and you have Rapid Rise or Instant yeast, you can substitute 25% LESS of the Rapid Rise or Instant yeast.

Example. A recipe says to use 1 tsp of Active yeast. You have Instant or Rapid Rise yeast.

$$.25 \times 1 \text{ tsp of active} = .25 \text{ tsp}$$

1 tsp of active - .25 tsp = .75 tsp of Instant yeast
A possible easier way is to say 75% of Active yeast amount is the amount of Instant yeast you can substitute.

Likewise, if a recipe calls for Instant or Rapid Rise yeast and you only have Active Yeast, you will need to use 25% MORE of the Active Dry yeast than what is called for. Example

2 tsp of Instant or Rapid Rise $\times 1.25$ (%125) = 2.5 tsp of Active Dry yeast.

Baker's Percentage

The Baker's Percentage is the present quantity of each ingredient as a percentage by weight of the amount of flour which is always set to 100%.

As an example, suppose I have a recipe that has 1 cup of flour (about 180 grams) and a half of a cup of water (about 118 grams).

The baker's percentage is....

$$\frac{118 \text{ g H}_2\text{O}}{180 \text{ grams Flour}} \times 100 = 65\% \text{ Baker's Percentage}$$

Option A and B - Baker's Math Continued

Please fill out the table and show your work.

1. A recipe calls for 1.5 tsp of instant or rapid rise yeast. How much Active yeast could be substituted?

Answer

2. A recipe calls for 2.5 tsp of Active yeast. How much instant or rapid rise yeast could be used?

Answer

3. Pizza Bianca pizza dough calls for 3 cups of flour and $1 \frac{1}{2}$ cup of water.

- A. Convert these to grams.
B. Find the "baker's advantage"

A. Grams?

B. Baker's Advantage?

Mixing it all together

❑ Option A

Option A - Research two different types of breads. Provide their recipes and cooking instructions. Describe the difference between the breads and the difference between the recipes. Be VERY clear about how changing an ingredient (chemical) changes the outcome of the bread. Upload your final paper to Google Classroom.

❑ Option B

Option B - Research a simple yeast bread recipe. Make two loaves. Follow the recipe . For the second loaf decrease the amount of water by 25 to 30%. Record the outcome and explain, based on the change in the chemicals, the differences. You can do a slide show, paper or video. Upload to google classroom. Feel free to contact the instructor for recipes or ideas.

A Simple Method and Recipe for Bread

