



# Science of Baking

**Pillar:** STEAM

Utilize problem solving skills and the scientific method to discover the science of how chemistry is involved with cooking/baking.

ENTREPRENEUR

We use science and math in many of the fun things we do every day, we just don't always recognize it! Baking requires lots of STEM and the final product is tasty too!

In any baking recipe, every ingredient has a purpose.

**Baking soda and powder** make baked goods rise. How does it do that? When mixed in batter, it makes carbon dioxide bubbles that help the cookies/cakes to rise.

**Flour** gives the base and structure. There are 2 types of protein in flour called glutenin and gliadin. When water is added to the flour, the proteins come together and form a new protein called gluten. Later, inside the oven, the proteins and starches in the flour turn into a sturdy structure.

**Fats** make our treats less chewy. They are awesome tenderizers. They coat the proteins in the flour, which prevents them from mixing with water and forming gluten.

**Sugar** adds sweetness and moistens our treats.

**Eggs** help bind ingredients together. When it's heated, the protein in the egg opens up and helps bind by making the batter into a semi-solid state. It also prevents crumbling and gives a smooth creamy texture.

Every ingredient also needs to follow a certain proportion. Most people follow a recipe when baking. As they get familiar with it, they tweak it to get better and better results.

1. Find out about baking soda and baking powder (Discover, connect)
  - a. What is the difference?
  - b. Here's an explanation: <https://www.bonappetit.com/story/baking-powder-vs-baking-soda-difference>

Do this experiment to see the different between baking powder vs baking soda

Equipment & ingredients:

- Measuring cup
- Teaspoon
- Clear Cups
- Water
- Vinegar
- 100% juice
- Stopwatch or timer

Directions:

You will test baking soda in each of the 3 liquids: water, vinegar, and juice. Then you will test baking powder in each of the 3 liquids: water, vinegar, and juice.

Fill a clear cup with  $\frac{1}{4}$  cup of water. Add 1 teaspoon baking soda and start the timer. Finish timing when all the little bubbles stop rising to the surface. Record your answer.



Repeat with remaining 5 variations: vinegar/baking soda, juice/baking soda, water/baking powder, vinegar/baking powder, juice/baking powder.

- c. Based on what you have now learned in the above steps, discuss why you would use one vs the other.
  - d. Learn more about it here: [https://www.youtube.com/watch?v=GXRouroc\\_ZY](https://www.youtube.com/watch?v=GXRouroc_ZY)
3. Learn about fats. (Discover)
- a. What are different types of fats you can use to bake?
  - b. Butter? Oil? Margarine? Crisco? What are the differences?
  - c. Learn more about it here: <https://www.wenthere8this.com/cooking-fat/>
  - d. Learn about the role of fats: <https://www.youtube.com/watch?v=LouNnXUmANs>
  - e. Here is another video about fats: <https://www.youtube.com/watch?v=CCOtKgtKV14>
  - f. Why is the type of fat important in some baking recipes and why not in others?
4. Learn about Flour (Discover)
- a. What exactly makes up flour and where does it come from?
  - b. More about flour here: <https://www.youtube.com/watch?v=pkEp26sck58>
  - c. What can you substitute for flour?
  - d. Here is a video to explain gluten: <https://www.youtube.com/watch?v=zDEcvSc2UKA>
5. Learn about the role of eggs (Discover)
- a. Read more about the role of eggs in baking here:  
<https://www.thekitchn.com/baking-school-day-1-all-about-eggs-and-baking-222479>  
Functions of eggs:  
<https://www.youtube.com/watch?v=N4UOxLGnFfY>  
[https://www.youtube.com/watch?v=uq-y\\_w-ZQbQ](https://www.youtube.com/watch?v=uq-y_w-ZQbQ)
  - b. What can you use as a substitute for eggs?
6. Learn about sugars (Discover)
- a. What types of sugars can you put in cookies?
  - b. Learn more about the function of sugar in baking: <https://www.youtube.com/watch?v=jKFILK2ktTk>
  - c. What can you substitute for sugar?
  - d. Discuss: can there be too much sugar or too little sugar? How much is enough?
7. Find the original Girl Scout cookie recipe and make it (Discover, Connect, Take Action)
- a. Test it by changing up some of the ingredients
  - b. Share your results with an audience

Check out this fun video: <https://www.youtube.com/watch?v=n6wpNhyreDE>

Cakes: <https://www.youtube.com/watch?v=XTcaAZYUJns>

Are you loving these STEAM activities? Do you want more to extend your learning? Check out our Pinterest Boards at [https://www.pinterest.com/gprograms/\\_created/](https://www.pinterest.com/gprograms/_created/).



**When you're finished:** Congratulations, you have completed this activity! If you made the original Girl Scout cookie recipe or made any type of cookie during this activity, you have earned the Cooking fun patch!! Order online now at <https://www.girlscoutshop.com/GSKSMO-Cooking-Fun-Patch>

