

STEM Hands-on activity

The SCIENCE involved in brushing your teeth
(Suitable for middle school students)

Overview:

In this experiment, students will see the effect of a carbonated drink on an eggshell, which will act as a tooth.

Background:

Eggshells are used in this experiment as a substitute for teeth, because both contain a high percentage of calcium minerals. Eggshells contain mainly composite calcium carbonate, with some calcium phosphate; whereas tooth enamel is a composite calcium phosphate.

The eggshell is half coated in toothpaste. The calcium fluoride in the toothpaste protects this half of the eggshell in the same way that toothpaste protects our teeth.

- Goals:
1. To see the effect of carbonated drinks on an eggshell
 2. To show that toothpaste has a protective effect
 3. To encourage students to see the importance of brushing their teeth

Safety: This experiment should **NOT** be carried out if anyone has an egg allergy. Care should be taken when using the eggs and all spillages wiped up quickly. The soft drink mix and egg should be disposed of after use.

Materials:

- Egg
- Carbonated drink such as tonic water or clear soda
- Toothpaste
- Pen
- Small bowl or plastic cup
- Spoon
- Water
- Paper towels

Method:

Please note that this experiment must be set up quickly to allow the eggshell to be left for a length of time and the carbonated drink to take effect.

1. Coat half the eggshell with a thick layer of toothpaste from top to bottom as shown in Figure 1. Mark which side is which.
2. Place the egg in the small bowl/plastic cup.
3. Add enough carbonated drink to the bowl/cup until the whole egg is immersed. If the egg floats, you may need to weigh it down with a spoon.
4. Leave the egg in the bowl/cup for at least 30 minutes, longer if possible. Look at the experiment occasionally throughout this time.
5. After the time is up, carefully remove the egg from the bowl/cup.

6. Wash the egg with water and wipe dry with the paper towel.
7. **Gently** tap the egg on both sides.
8. Break the eggshell, disposing of the egg yolk and egg white.
9. Wash out the eggshell.
10. Compare both sides of the eggshell, by breaking a piece off each side.



Figure 1: Picture of the egg half coated in toothpaste.

Suggested questions to ask students [and expected results]:

- What do you notice when you added the carbonated drink to the egg? [It should start to bubble.]
- Do you notice what is happening throughout the 30 minutes (or longer)? [There will be lots of bubbles. The carbonated drink will start to go cloudy. The toothpaste layer on the egg will look as if it is being “eaten away”.]
- When the egg comes out of the carbonated drink, do you notice anything? [Most of the toothpaste will have been removed.]
- What happened when you washed the egg? [A layer rubs off the side of the egg without the toothpaste on it, as shown in Figure 2.]

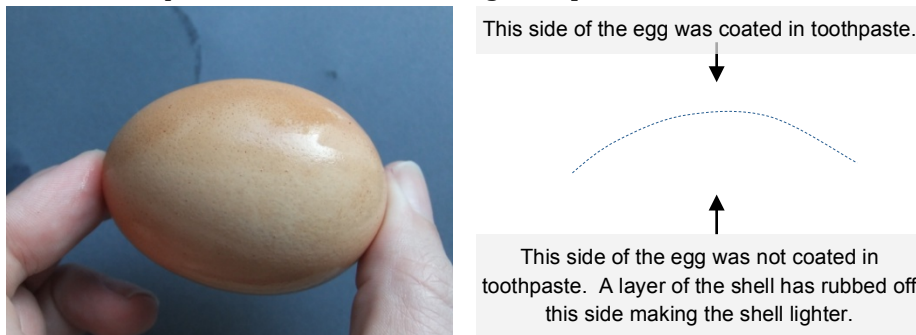


Figure 2: Picture of egg after being immersed in lemonade with half the egg coated in toothpaste.

- When you tapped the egg, was there any difference? [There is a subtle difference in how each side sounds.]
- When you broke a piece off the eggshell, did you notice any difference? [The half without the toothpaste breaks easier and seems more brittle compared to the half that had the toothpaste over it (see Figure 3).]

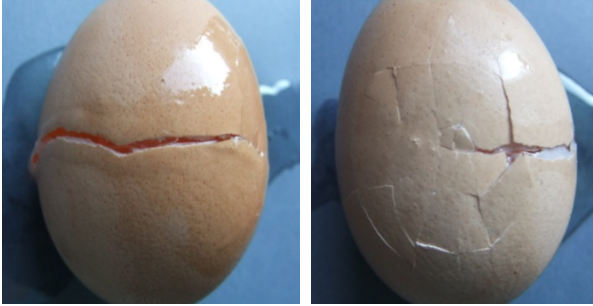


Figure 3: Pictures of the egg after cracking the shell. The photo on the left hand side shows the side that had the toothpaste on it. While it has cracked, it is one crack. The photo on the right hand side shows the side that had no toothpaste on it. When this was tapped, the egg shell broke into lots of little bits. Both photos are taken in the same light conditions and so this also shows the change in colour due to the layer being “rubbed off” the half of the egg with no toothpaste on.

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