

## INVISIBLE INK

If you like to pretend play to be a spy or a secret agent, then here is just the activity for you! Mix up a batch of this special ink formula to keep secret codes and top secret messages safe from the eyes of non-spies. You'll also learn a bit about the fascinating powers of lemons and lemon juice.

### Supplies needed:

- ½ of a fresh lemon or bottle of lemon juice
- Spoon and bowl
- Water
- Clean paintbrush or cotton swab
- White paper
- Lamp with light bulb

Squeeze lemon juice into the bowl. Add a few drops of water, then stir together with the spoon.

Think about what you'd like your secret spy message to say, then dip the paintbrush or cotton swab into the liquid and write your message onto the paper.

Let the juice dry so that your message becomes invisible. You can speed up the drying process by blowing on the wet paper or taking it outside when the weather is warm (or hot!).

To read the message, turn on the lamp and heat the paper right over the light bulb until you are able to read your secret message. Be very careful not to touch the hot light bulb directly.

Share this secret ink formula with your friends and exchange spy messages with each other, remembering to always keep your messages kind and considerate. The very best secret agents always do!

### How it works

Lemon juice is an acidic liquid that turns brown when it is heated. By mixing the lemon juice with water, you dilute the juice and make it much harder to see on the paper. Acidic liquids weaken the paper you apply it to. When you heat the paper, the section where your message was written oxidizes, meaning it combines with oxygen, and burns faster than the surrounding paper. This makes the lemon juice you used for "invisible ink" turn brown and reveal your secret message.

Experiment with other acidic liquids like orange juice, vinegar or milk and see how those work as compared to the lemon juice. Just anything acidic can be used as invisible ink.

You can also decode secret messages another way and make them appear without using heat. Try putting salt on the ink immediately after writing your message. Wait 60 seconds, wipe the salt off the paper, and then color over the writing with a crayon. Your message will magically appear!

Additional resources:

<https://www.stevespanglerscience.com/lab/experiments/secret-lemon-juice-messages/>

<https://researchparent.com/color-changing-invisible-ink/>

<https://wonderopolis.org/wonder/how-does-invisible-ink-work-2>