



INVISIBLE INK!



Credit: thiswestcoastmommy.com

Throughout history, invisible ink has been used to write messages between prisoners and even spies! The ink on the paper can't be seen until the person who wants to read it "activates" it. Here are three ways of making invisible messages to share with your family or friends!

OPTION 1: INVISIBLE INK + HEAT

MATERIALS:

- Paper
- Bowl
- Lemon juice*
- Cotton swab (or anything to apply the ink, like an old paintbrush, your finger, etc.)
- Source of heat with adult guidance (an incandescent lightbulb, an iron on low heat, or an oven).



Credit: clipart.email

INSTRUCTIONS:

- Add the lemon juice to a bowl (the amount depends on how many messages you want to write).
- Using a cotton swab or something similar, write or draw out your message on a piece of paper. While the ink is still wet, you'll be able to see what you're doing.
- Let the paper dry completely; now the ink should truly be invisible!
- With the help of a parent or guardian, apply heat to the paper, taking care to not let the paper burn. When heat is applied, the ink will turn brown faster than the rest of the paper, letting you read the message! Heat can be applied in several ways...
 - Hold the paper up to an incandescent lightbulb (the lightbulb cannot be a low energy one, the lightbulb needs to be letting out heat).
 - An iron on low heat (and not on the "steam" setting) can be run over the paper until the ink is activated.
 - The paper can be placed in the oven on low heat or over a stove top for a brief amount of time (be careful to watch the paper, so it doesn't burn).

HOW DOES IT WORK?

The invisible ink, lemon juice in this case, is acidic. The acid in the ink attaches to the paper, creating compounds. When these compounds get hot, they burn and change color (like toast)! This process is called *oxidation*.

*Try other liquids instead of lemon juice, like orange juice, milk, or vinegar! Which works the best?

OPTION 2: INVISIBLE INK + INDICATOR SOLUTION

(An *indicator solution* is a liquid that shows, or *indicates* something.)

MATERIALS:

- Paper
- Two bowls
- Water
- Baking soda
- Cotton swab (or anything to apply the ink, like an old paintbrush, your finger, etc.)
- Grape juice or cranberry juice (this is the indicator solution)



Credit: skipitomylib.org

INSTRUCTIONS:

- Mix equal parts of baking soda and water in a bowl. Warm water is better, since it makes the mixing process easier, but it is not necessary.
- Using a cotton swab or something similar, write or draw out your message on a piece of paper. While the ink is still wet, you'll be able to see what you're doing.
- Let the paper dry completely; now the ink should truly be invisible!
- Pour some grape or cranberry juice into a bowl. Using a cotton swab, an old paintbrush, or something similar, add the indicator solution to the paper. When it is added to the parts of the paper with invisible ink, it will change color, letting you read the message!

HOW DOES IT WORK?

The way this ink works is based on pH, a scale of *acid* and *alkaline*. Baking soda is *alkaline*, or basic. The juice, or indicator solution, is *acidic*. When basic and acidic things combine, they create a *chemical reaction*. So, when the indicator solution touches the invisible ink, a chemical reaction happens, and the ink changes color!

OPTION 3: INVISIBLE INK + GRAPHITE

MATERIALS:

- Paper
- One bowl
- Hot water
- Salt
- Cotton swab (or anything to apply the ink, like an old paintbrush, your finger, etc.)
- Regular pencil

INSTRUCTIONS:

- With an adult's help, pour hot water into a bowl. Gradually add salt and mix until the salt has completely dissolved. Do this as many times as possible, until the salt will no longer dissolve. (This is called a saturated solution).
- Using a cotton swab or something similar, write or draw out your message on a piece of paper. While the ink is still wet, you'll be able to see what you're doing.
- Let the paper dry completely; now the ink should truly be invisible!
- Lightly run the side of a pencil across the paper. You should find that where the invisible ink is, the pencil lead looks darker, letting you see the message!

HOW DOES IT WORK?

As the salty water dries on the paper, the salt forms *crystals* on top of the paper. When the pencil comes into contact with these crystals, the *graphite* (the darker color from the tip of the pencil) grabs onto them, adding more color.



Credit: Mad Scientist Group via YouTube

See the final page for more science resources.

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- For more invisible ink, visit [Explora for Grades K-8](#) and search "invisible ink".
- For fun books about science, visit [TumbleBooks](#) and search "science".
- For a book about truly wacky science experiments, visit [Overdrive](#) and search "11 Experiments That Failed".



These experiments were inspired by projects from the websites below:

www.madscience.org

www.scienceprojectideas.co.uk

www.stevespanglerscience.com