

Iodine Fingerprint



Introduction

Forensic scientists use fingerprints as one of the basic tools in gathering evidence at the scene of a crime. Fingerprints can be developed using a number of chemical and physical methods. In this activity, fingerprints will be developed chemically in iodine vapor.

Concepts

- Sublimation
- Forensic science

Materials

- | | |
|--|-------------------------------------|
| Contact paper, clear and colorless, 2 × 4 cm, 2 pieces | Hot plate |
| Copper wire, 18-gauge, 12 cm | Index card cut to a 2 × 4 cm square |
| Erlenmeyer flask, 250-mL | Iodine, 2 small crystals |
| Glass wool or foam plug | |

Safety Precautions

Iodine is toxic by ingestion and inhalation. It reacts violently with reducing materials, sulfur, iron, alkali metals, metal powders, and phosphorus. Iodine is a skin irritant and is corrosive to the eyes and respiratory tract. Inhalation or ingestion may be fatal. Wear gloves when handling glass wool. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Perform this activity in an operating fume hood.
2. Bend the copper wire so that it can be used as a hook. Punch a small hole in the top of the index card and hang the card from the copper wire. Hold the index card by the edges to prevent extra fingerprints from developing on the card.
3. Press your finger against the index card so that a good print is transferred to the card. Repeat on the back side of the card.
4. Place two small crystals of iodine inside a dry, 250-mL Erlenmeyer flask.
5. Suspend the index card in the Erlenmeyer flask and stopper the flask with the glass wool or foam plug.
6. Place the Erlenmeyer flask on the hot plate and warm it gently on a low heat setting.
7. Watch for the fingerprint to develop. It will take only a minute or two. After it looks fully developed, remove the flask from the hot plate. Do not heat the flask too long or the entire card will turn brown.
8. Remove the index card from the flask. Stopper the flask again with the glass wool or foam plug. Place a piece of clear, colorless contact paper on both sides of the card to preserve the fingerprint.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Allow any iodine vapor to dissipate in an operating fume hood. Any remaining solid iodine crystals can be reused or disposed of according to Flinn Suggested Disposal Method #12a.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Systems, order, and organization
Evidence, models, and explanation

Content Standards: Grades 5–8

Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standard E: Science and Technology
Content Standard F: Science in Personal and Social Perspectives, science and technology in society

Content Standards: Grades 9–12

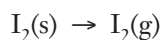
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter
Content Standard E: Science and Technology
Content Standard F: Science in Personal and Social Perspectives, science and technology in local, national, and global challenges

Tips

- Only two small crystals of iodine are needed to develop a good fingerprint. If more iodine is used, the fingerprint will develop too darkly and the entire card will most likely turn dark brown.
- Do not leave the index card in the flask too long or the entire card will turn brown. Instead, remove the flask from heat as soon as the fingerprint is clearly apparent.
- Cover the fingerprint with contact paper immediately after removing it from the flask to prevent the fingerprint from subliming.
- To make sure there is enough oil on the fingertips, rub them along the hairline or along the sides of the nose to pick up extra oil.
- This procedure will also work without warming the flask on a hot plate. However, it will take longer and the entire card is more likely to turn brown.

Discussion

At room temperature, iodine exhibits an equilibrium between its solid and gas phases. A phase change directly from the solid to the gas phase is called sublimation.



When your finger is pressed down onto the paper, oils from the skin are transferred to the paper. These oils then react with the iodine vapor, producing a brown color that traces the fingerprint.

The fingerprints developed in this activity are termed latent fingerprints because they are initially invisible to the naked eye. A latent fingerprint must be developed by some chemical or physical method. Visible fingerprints are those that can be seen with the naked eye, such as those traced out by ink, paint, or blood.

Latent fingerprints do not last forever because they can be smeared, wiped, or washed away from a surface. They can also fade away as the substance that formed the fingerprint evaporates into the air. Children's fingerprints fade much more quickly than adult's fingerprints, particularly in warm temperatures. This is due to the difference in the composition of the oils in a child's skin versus an adult's skin, which is thought to change during puberty. Before puberty, the oil in the fingers contains primarily small, fairly volatile, free fatty acids with approximately 13 carbons. After puberty, the composition of these oils in the fingers contains larger, less volatile alkyl esters with approximately 32 carbons. These larger esters are probably not actually secreted from the finger, but from oil glands in the face instead. They are then transferred to the fingers by touching the face. Because children's fingerprints contain more volatile components, they evaporate more quickly. This has implications when children are involved in crimes because their fingerprints may fade by the time the police arrive at the scene to dust for fingerprints.

References

Kimbrough, D. R.; DeLorenzo, R. J. *Chem. Ed.* 1998, 75, 1300–1301.

Fun with Chemistry—Laboratory Experience for Middle School Students, Institute for Chemical Education, University of Wisconsin: Madison, 1994.

Materials for the *Iodine Fingerprint* are available from Flinn Scientific, Inc.

Catalog No.	Description
I0007	Iodine, crystal, 100 g
GP3045	Erlenmeyer flask, 250-mL
C0148	Copper wire, 18-gauge, 4 oz
G0034	Glass wool, 100 g
AP4674	Hot plate, 4 × 4 in

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.