EXPLORE SCIENCE

LET'S DO CHEMISTRY

Chemistry Makes Scents Facilitator Guide

ACTIVITY LEARNING GOALS

Learners will develop positive attitudes toward learning about chemistry:

- Learners will increase their feelings of **interest** in chemistry by using their sense of smell to explore chemistry concepts, through hands-on manipulation of chemistry models, and by making connections to everyday life.
- Learners will increase their understanding of the **relevance** of chemistry by exploring the applications of chemistry and by exploring connections to everyday life.
- Learners will increase their sense of **self-efficacy** related to chemistry through hands-on interaction with models and by successfully doing and understanding the activity.

Learners will explore chemistry concepts, tools, and practices:

- Chemistry can help us understand our world and learn about how materials behave.
- Chemists use tools, like models, to discover and make new things.

FACILITATION STRATEGIES

- Encourage **interest** by allowing participants to manipulate the materials on their own.
- Help participants make connections to everyday life (**relevance**) by discussing where they have smelled these scents before. What do the smells remind you of? Start with the spearmint and caraway product cards face down until the visitors have shared what the smells remind them of. You can show participants the product image cards to help them become more familiar with both spearmint and caraway.
- Participants may build their **self-efficacy** and confidence in this activity through exploration of the models and by making their own mirror-image molecules.

MATERIALS

- Spearmint scent bottle: squeeze bottle and cotton ball with spearmint essential oil
- Caraway scent bottle: squeeze bottle and cotton ball with caraway essential oil
- Coffee bean scent bottle: squeeze bottle half filled with coffee grounds
- Extra cotton balls (for reset)
- Spearmint and caraway essential oils (for reset)

- Small hand-held mirror
- Mini Magic Nuudles
- Tray
- Black chenille stems (pre-cut into sixths)
- Step-by-step instructions for making mirror-image molecules
- Spearmint and caraway graphic
- Marker and labels
- Safety data sheets
- Gloves (optional)

SAFETY

Always follow and model prudent practices when doing chemistry activities.
Think about:

- What **hazards** exist and what associated risks may arise from these hazards?
- How to **minimize** risks through protocols we have designed into the activities and training materials.
- How **safe practices and protocols** should best be communicated with facilitators, participants, and others.

Label all containers with their correct chemical names and concentrations. Both essential oils are used as flavoring agents in foods and cosmetics and are considered non-toxic. The pure oils may be harmful if swallowed. The oils are mild skin and eye irritants, and direct contact with them may cause an allergic skin reaction. Facilitators setting up the scent bottles should wear gloves and wash their hands after handling the chemicals and should work in an area with good ventilation. Participants do not come into direct skin contact with the oils.

Encourage participants to squeeze the bottles and then waft the smells toward their nose with one hand. Demonstrate how to use the smell bottles. Remind children to NOT "sniff" the bottles or put them into their nose!

Your institution may have special rules or protocols for chemistry related activities, so check with your facilities staff, safety committee, and/or others. Learn more about safe practices in the *Let's Do Chemistry: Safety Guide* included in the physical kit and with the online digital kit resources.

ADVANCE PREPARATION

Prepare the scent bottles. Place label sticker on the bottom of each bottle: Spearmint, Caraway, Coffee. Add a few drops of each essential oil to its own cotton ball. Put the cotton balls in the corresponding bottles. Place ground coffee into the third squeeze bottle.

FACILITATION NOTES

Having a cold, the type of food they most recently ate, or chewing gum can affect a visitor's ability to identify the smells.

The squeeze bottle with coffee beans can be used as a "nasal palette cleanser" if a person's sense of smell becomes saturated by the activity. It can be helpful to set up your three squeeze bottles in a row with the coffee placed between the mint and caraway.

Chemistry Models: There is quite a bit of interpretation in the world of models. The 3D models in this activity are simplified to highlight the mirror-image nature of the carvone molecules. We're using the green atom/ball to represent what's called an "R group," or a collection of three carbons and five hydrogens. The simple take-home mirror molecules participants make **do not** represent real molecule structures, but are meant to help participants visualize the mirror-image structure of some molecules.

Discuss the similarities and differences between the two carvone models. They both have red oxygen atoms, and they both have a green area (which represents a more complex structure). They are both *cyclic*, or ring structures (hexagonal, round, etc.). You can count the number and kinds of atoms, which are also the same on both models. Demonstrate, however, that the two models cannot be overlaid on top of each other—they are *mirror images* of each other, not simply rotated structures. You can connect the smells to the models by explaining that, " Yes, the smells are different. Now, let's look at how these scents compare on a molecular level. We can't see structure on the molecular level with our eyes, but scientists use special tools, like really powerful microscopes, to observe and understand how molecules are put together."

Some participants may not be familiar with the terms *molecules* and *atoms*. The focus of this activity isn't about defining these terms, but rather using and hearing them in context. *Atoms,* like oxygen or hydrogen, are the basic pure units of chemical elements. *Molecules* are the smallest particle an element or compound can be broken into without changing its chemical or physical properties. Both atoms and molecules are extremely small.

Younger visitors may be more interested in building molecules than smelling the mint and caraway. If the mirror molecules are too complex, invite them to build a water molecule (H_2O) and talk about molecules as tiny building blocks that make up everything around you—including smells.

An activity training video is available at vimeo.com/channels/nisenet.

ADDITIONAL BACKGROUND

For younger children, you can start by saying that sometimes mirror-image molecules can act differently in the body. One might be good, while the other might be harmful. And it's important to know which is which before using it. Sometimes the mirror-image molecule acts the same, and sometimes it is inactive. For example, ibuprofen, the active ingredient in Advil and Motrin, is a common medication for which this is true. Other common over-the-counter drugs can also be used as examples, including omeprazole (Prilosec for heartburn), naproxen (Aleve), atorvastatin (Lipitor for lowering cholesterol), and albuterol (asthma inhalers).

Methamphetamine is a good example that can be used when discussing the properties of mirror-image molecules with adults. One form can be obtained legally but the other form is usually associated with the manufacture and use of illegal drugs (like crystal meth). Forensic scientists can test for the two forms to determine whether or not a person has taken legal or illegal drugs. More information: http://www.premiertox.com/post/methamphetamine-d-and-l-isomer-testing-basics

A particularly tragic example of why it's important for chemists and other scientists to understand the properties and behavior of mirror-image molecules is *thalidomide*. This example really only works as a conversation point with adults and some older teens. Thalidomide was used to treat morning sickness in the 1950s. However, many of the babies born to mothers who took this drug when they were pregnant suffered birth defects. One form of thalidomide got rid of morning sickness and the mirror-image form inhibited blood vessel growth, which is essential for fetal development. With recent advances in medicine, thalidomide is now once again being used—this time to treat cancer. It works to stop blood vessel growth that aids tumors, and doesn't otherwise affect non-pregnant individuals. More information: http://helix.northwestern.edu/article/thalidomide-tragedy-lessons-drug-safety-and-regulation

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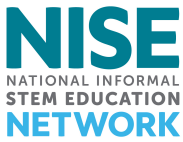

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