Make and Take Lotion

Lotions contain oil to soften skin and water to keep it moisturized. While both promote healthy skin, this can be a troubling combination because oil and water famously separate. Find out how oil, water, and other key ingredients, work together to become skin-protecting lotion.

Question to investigate

How does chemistry solve the problem of oil and water not mixing?

Chemistry content

- Oil and water are not attracted to each other and will begin to separate after being mixed.
- Two types of molecules solve the problem of oil and water so that they do not separate.
    - One is an emulsifier that connects droplets of oil and water molecules.
    - The other is a long polymer that is very attracted to water, Water surrounds these polymers and hold the droplets of oil in place so that they don't all float up to the top.

Special considerations

- Using a preservative is optional. If not used, tell people that the lotion must be stored in the refrigerator and used within two weeks.

Time required	Age range	Group size
Preparation 30 minutes Activity 8-10 minutes	6 – 18 years	• One participant per station • 1 presenter per 2 stations • 4 stations can fit along one edge of a 6- or 8-foot-long table to serve up to 24 participants per hour

Prior to the activity

1. If using Germal Plus, portion into 4 labeled dropper bottles.
2. Make "Lotion" labels to place on each portion of lotion that goes home.
3. Make copies of the lotion take-home information that includes the warning, "For external use only; may irritate eyes."
4. Either use a large plastic beaker or pinch two tall clear plastic cups to make a pour spout and use a permanent marker to label these cups "water."

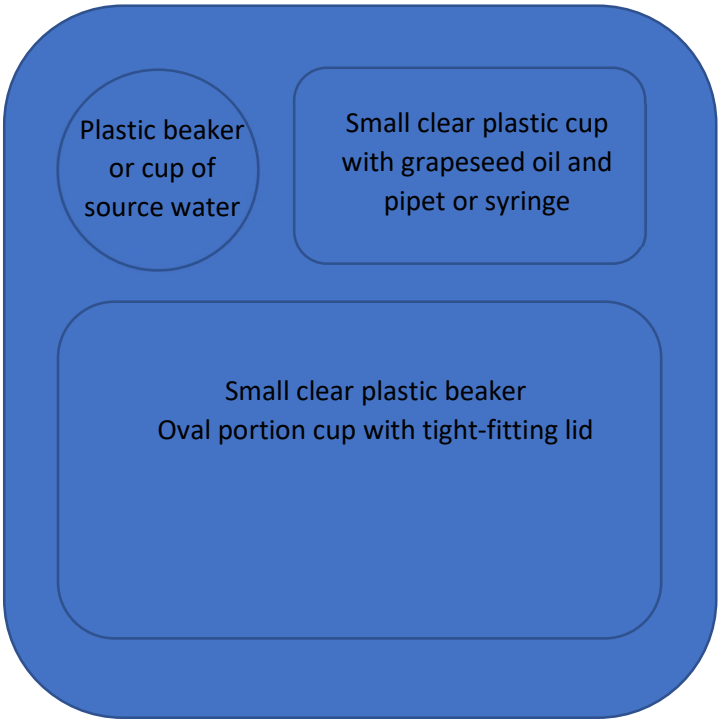
Materials

For 4 stations operating continuously for one hour

- Splash goggles for all facilitators, participants, and spectators
- GelMaker®EMU from Making Cosmetics, $24.90 for a 125 mL bottle that will be enough for at least 72 participants to each make a sample of lotion
- Newspring® Pactive Ellipso 2-ounce portion containers with snap-on lids
  3 essential oils or other fragrance oils intended for use on skin such as:
  - Cotton candy
  - Strawberry
  - Orange
- Grapeseed oil, 250 mL bottle
- 1-gallon distilled water, only need about 1 quart
- 4 small plastic beakers or medicine cups that can measure up to 30 mL
- 4 graduated pipets or oral syringes intended to deliver medications by mouth
  1 mL graduations
- 4 small clear plastic cups labeled, grapeseed oil
- 2 plastic beakers or tall clear plastic cups to help pour distilled water.
- 4 Plastic stirring rods, wooden popsicle sticks, or spoons
- 4 divided spill trays
- Germal Plus and 4 labeled dropper bottles, optional
- Paper towels

Prior to the activity

5. If using Germal Plus, portion into 4 labeled dropper bottles.
6. Make "Lotion" labels to place on each portion of lotion that goes home.
7. Make copies of the lotion take-home information that includes the warning, "For external use only; may irritate eyes."
8. Either use a large plastic beaker or pinch two tall clear plastic cups to make a pour spout and use a permanent marker to label these cups "water."



Prepare on site

1. Arrange four trays along the front of the table close to participants.
2. Place items on each tray as shown.

Onsite activity

Step	Details	Ask participants
Introduce lotion	• Tell participants that they will make a very simple lotion with you that uses only four ingredients. They will be able to take this lotion home and use it, too. • Explain that lotion is meant to moisturize skin, so it's no surprise that it contains water. • Lotion is also meant to make skin more flexible so that it is less likely to crack.	• What is lotion like? • Why do people use lotion?
Add water and oil to the oval container	**Direct participants to:** • Use the small plastic beaker or medicine cup to measure 30 mL of water and pour it in the portion cup. • Use a syringe to measure 3 mL of grapeseed oil and transfer this amount to the oval portion cup.	• Lotion contains both oil and water. Do you think lotion has more oil in it or more water?
Observe, snap, shake, and observe	**Direct participants to:** • Look closely at the oil and water. • Snap the lid securely on the container. • Shake the container for about 10 seconds. • Open the lid and observe the oil and water.	• What do you notice about the oil and water? • How can we get the oil and water to mix? • Is this like lotion? • Would you call this a mixture, solution, suspension, or emulsion?
Add the emulsifier, shake, and then open the lid	• Explain that oil and water do not mix. If we wait long enough, all of the oil, will float on top of the water again. • We can add a molecule that acts like a bridge between the oil and water—one that has a part that can mix with oil and another part that can mix with water. This kind of molecule is called an **emulsifier**. **Direct participants to:** • Use a graduated syringe or pipet to add 1½ mL of GelMaker to your oil and water.	• How can we get oil and water to mix? • Do you hear or feel a change in the oil and water as you shake the container?

	• Snap the lid securely on the container and shake for another 10 seconds. • Open the lid.	
Make observations of the oil, water, and emulsifier	• Let participants know that the lotion will become creamier after it sets for a few hours. • Explain that this is an emulsion because tiny droplets of oil are temporarily connected to water molecules by an emulsifier. • Gelmaker contains both an emulsifier and a superabsorbent polymer that is very attracted to water molecules. This polymer gives the lotion some structure and will prevent the water from evaporating quickly when you apply it to your skin.	• How is this like lotion that you have used? • Would you call this a mixture, solution, suspension, or emulsion? • How is your lotion different from other lotion that you have used?

Choose and add a scented oil and antibacterial solution if desired	**Direct participants to:**
	• Choose and add a few drops of fragrance oils directly from each bottle.
	  ○ Decide whether you will allow participants to make a custom scent from the essential oils or fragrances offered. If you do, limit them to a total of 4 drops.
	• If offering Germall Plus, ask participants if they would like to add 1 drop of preservative to prevent the growth of mold and bacteria.
	• Give participants the take-home information and invite them to take their lotion with them.
	• Tell participants that if they were to look on the side of a bottle of lotion, they will likely see a long list of ingredients. These ingredients serve different purposes. For example glycerin is a humectant that helps your skin absorb the emulsion.
		• How does chemistry solve the problem of oil and water not mixing?
		• Did anything surprise you about making lotion?
		• Why would someone want to add a preservative?
		  ○ Or not add a preservative?
		• What are some things you hope your lotion will do? There's likely a chemical for that!

How does this work?

Lotions are one form of preventative skin care; keeping your skin hydrated keeps it healthy. Adding water on its own does not help moisturize your skin for long because wet skin loses water much faster than dry skin does. Lotions can contain substances that prevent moisture loss from or even attract moisture to the skin. Even the simplest formulation of lotion, as made in this activity, contains **emollients**. These are oils that make skin more flexible and less likely to tear or crack (ouch!)

Lotions usually consist of mostly oil and water, but the ratios vary. The simplest emulsions are "oil in water" (sometimes referred to as "O/W" where water is the highest volume ingredient, and its opposite, "water in oil" ("W/O") where oil is most of the formulation. Some lotions contain a blend of different types of oils.

We know from experience (especially if you have ever used Italian salad dressing) that oil and water do not "get along" (don't mix). This activity demonstrates the utility of a "bridging agent" that has dual functionality—the molecule has one part that mixes well with water and one that does so with oil. This type of material is called an **emulsifi**er, and the product that results from the oil-water compatibility promoted by the emulsifier is called an **emulsion**.

The product, GelMaker, contains both an emulsifier and the polymer sodium polyacrylate. Other ingredients allow it to be used at room temperature, rather than heating like many other emulsifiers require.

References:

- ACS Committee on Community Activities
- Activity developed and written by Dr. Regina Malczewski
- Public-facing instructions written and designed by Dr. Robin Tanke
- Facilitation plan and take-home safety instructions edited by Patti Galvan

How does Lotion both Moisturize and Keep Skin Flexible?

Lotion contains both oil and water but oil and water do not mix! What do chemists do to make a lotion containing oil and water that stays mixed? Wear goggles when doing this activity.

Step	Details	
Add water and oil to the portion cup with lid	• Pour the 30 mL of distilled water provided and into the cup. • Use a graduated syringe or dropper to add 3 mL of grapeseed oil to the cup.	
Observe, snap, shake, and observe	• Look closely at the oil and water. • Snap the lid securely on the container. • Shake the container for about 10 seconds. • Open the lid and observe the oil and water.	
Add optional fragrance and preservative (If you choose not to add a preservative, please keep your lotion in the refrigerator and use within two weeks)	• Do you want a scented lotion? Add 3 drops of fragrance. Coconut  Peppermint  Lemon  Lavender  • Do you want a lotion that can be stored at room temperature? Add 1 drop of Germal Plus • Shake the container for about 10 seconds. Observe.	
Add the emulsifier, and shake, and then open the lid	• Use a graduated syringe or dropper to add 1½ mL of GelMaker to your oil and water. • Snap the lid securely on the container and shake for another 10 seconds. • Open the lid and observe.	
Make observations of the oil, water, and emulsifier The lotion will become creamier after it sets for a few hours.	• Lotion is an emulsion because tiny droplets of oil are temporarily connected to water molecules by an **emulsifier.** • GelMaker contains both an emulsifier and a superabsorbent polymer that is very attracted to water molecules. This polymer gives the lotion some structure and will prevent the water from evaporating quickly when you apply it to your skin. • The lotion is for external use only and may irritate eyes.	

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What is this lotion made of?

This lotion is mostly water with a comparatively small amount of oil added. Because oil and water do not mix, an ingredient that acts as a bridge between oil and water was added. This chemical bridge, or emulsifier comes from GelMaker EMU, a product from the company *MakingCosmetics*. In truth, GelMaker consists of several ingredients which work together as both emulsifiers and thickeners, to transform the oil and water into thick, creamy, skin-hydrating lotion. It's that simple! You may have used optional add-ins, such as natural or synthetic fragrance oils or a liquid such as Germal Plus to inhibit the growth of mold and bacteria.

Is this lotion safe to use?

This lotion is for external use only and may irritate the eyes. The ingredients in this lotion are safe to apply on the clean skin of most people. Do not use the lotion if you have known allergies to the oils used or if you are sensitive to many commercial lotions.

How do I use and store this lotion?

Use clean hands when touching or applying the lotion. Also, be sure to use the entire volume of lotion within one week. If you used a preservative, such as Germal Plus, the lotion will remain safe to use for several weeks, even if kept at room temperature. Be sure to store the lotion away from young children or pets and away from food. If the lotion develops fuzz, spots, or a peculiar odor, dispose of the lotion in its sealed container with the household trash. Then, thoroughly wash your hands with soap and water.