

## PROTOCOL: MAKING LOTION (SKIN MOISTURIZING EMULSIONS)

---

Here we are focusing on an extremely popular emulsion type (lotions) where water droplets are dispersed in a continuous oil phase. Lotions are used to moisturize, and can be used as carriers to deliver important molecules into the body through our largest organ -- skin.

You can use any number of different oils to make lotion, even ones in your kitchen! You can also change the consistency and texture of the lotion by playing around with the amount of water you use in the lotion recipe. But, because water and oil do not easily mix, we have to add a special bridging molecule to make the water and oil “get along.” This bridging compound keeps the water and oil mixed together.

Because this is an experiment with a lot of moving parts, we have to make sure that we are preparing some things in advance. Here are a few tips:

1. Make sure your work surface, equipment, and containers are clean. You are making something that goes on your skin -- you don't want it to be gross.
2. Organize your raw ingredients -- things might move fast, so it is best to have everything ready
3. Read through the protocol before starting so you know what to expect
4. Don't worry if things are not “perfect.” The point is for you to make something, and to have fun!
5. If you are ever unsure about something, please do not hesitate to ask for clarification.
6. You are working with stuff at or close to boiling temperatures. Please put safety first **AT ALL TIMES**.

## List of Materials and Equipment

Ingredients	Equipment
<ul style="list-style-type: none"><li>• Oils (here we will use a mix)</li><li>• Beeswax</li><li>• Emulsifying Wax</li><li>• Stearic Acid</li><li>• Water</li><li>• Glycerin</li><li>• Essential oils of your choosing to “flavor” the moisturizer</li></ul>	<ul style="list-style-type: none"><li>• Container for mixing</li><li>• Utensils for scraping</li><li>• Thermometer</li><li>• Kitchen Scale</li><li>• Measuring Cups</li><li>• Stick Blender</li><li>• Kettle</li><li>• Double Boiler or water bath</li><li>• Containers for moisturizer</li><li>• Labels and pens</li><li>• Notebook for record keeping</li></ul>

## Ingredient Descriptions and Purpose

The following table provides an explanation of how each ingredient contributes to making the emulsion (lotion). Each chemical component (yes, these ingredients are definitely chemicals!) is described by the following terms:

**Polarity:** Describes the separation of an electric charge within a single molecule. Molecules can be nonpolar or polar.

Nonpolar the electric charge is equal throughout the molecule

Polar the electric charge is far enough apart to cause one portion of the molecule to have a positive charge and another portion of the molecule to have a negative charge (opposite charges in a single molecule)

**Solubility:** Describes the properties of a molecule that allow it to dissolve in a solvent. Solubility is related to the polarity of the molecule.

Hydrophobic molecules are nonpolar and are not soluble in water (polar molecule).

Hydrophilic molecules are polar and can dissolve in water.

An **Amphiphile** describes a molecule that has both nonpolar/hydrophobic and polar/hydrophilic properties. Greek in origin, amphiphile translates to “friendship.” In emulsions, an amphiphile helps to mix molecules that are normally immiscible.

Chemical Component	Polarity	Solubility	Melting Point*	Description & Purpose
Water	Polar	Hydrophilic	0C	Chemical that is vital to all life on earth. Here, water will serve as the main portion of the continuous phases for our lotions.
Beeswax	Nonpolar	Hydrophobic	64C	Produced by bees, this tough wax is a combination of fatty acid molecules that are bonded to alcohols containing long hydrocarbon chains. Beeswax is an increasingly common ingredient in skincare products due to its contributions to texture and moisturizing qualities.
Coconut Oil	Nonpolar	Hydrophobic	24C	Extracted from coconut kernels, this oil has a very high saturated fat content (which is why it is solid at room temp.). It has a long shelf life compared to other oils, and helps give lotion a creamy texture.
Emulsifying Wax	Amphiphile		54C	This vegetable-based product is a common chemical found in nearly all cosmetics. It serves as the bridge between hydrophobic and hydrophilic components, stabilizing the emulsion.
Oils (various unsaturated)	Nonpolar	Hydrophobic	-10C	These vegetable-based chemicals are liquid at room temp. and are composed of long hydrocarbon chains. Oils help to provide a lustrous and smooth texture when making lotions.
Stearic Acid	Nonpolar	Hydrophobic	70C	This 18-carbon saturated fatty acid is one of the most common fatty acids on earth. Highly enriched in shea and cocoa butters, this chemical helps to provide a “pearly” effect in cosmetics.
Glycerin	Polar	Hydrophilic	18C	This colorless, odorless, viscous alcohol is widely used in cosmetic, food, and pharmaceutical industries. Its humectant properties helps to keep in moisture and provide lotion with a smooth, glossy texture.

\*Under normal atmospheric pressure

### Recipe A Calculations

<b>LOTION RECIPE A</b>			
<i>Raw Ingredient</i>	<i>Percent</i>	<i>For 1 Person (100ml)</i>	<i>For 20 Persons (2000mL)</i>
Grapeseed Oil	12%	12g	240g
Sunflower Oil	12%	12g	240g
Emulsifying Wax NF	6%	6g	120g
Stearic Acid	1%	1g	20g
Water	64%	64g	1280g
Glycerin	5%	5g	100g
<b>Total</b>	<b>100%</b>	<b>100g</b>	<b>2000g (2000mL)</b>

### Recipe A Protocol

1. Weigh out your **hydrophobic** components and add them to a labeled mason jar.  
*The hydrophobic components are those that are not soluble in water -- Grapeseed Oil, Sunflower Oil, Stearic Acid.*
2. Weigh out the emulsifying agent (emulsifying wax NF) and add to the mason jar containing oils. Close up the mason jar and put it in a water bath that has been heated to ~60C.
3. Start boiling the water you will need using a kettle.
4. As the water is boiling, weigh out the glycerin and add it to the beaker.
5. Once the water is boiled, weigh the amount of water needed and add it to the beaker containing glycerin.
6. Prepare your station for creating the emulsion by gathering your emulsion blender.

7. Also find the largest beaker and fill it about one third of the way with ice water (this will be used in a few minutes).
8. When everything is ready, insert the blender into the water and glycerin mixture to create a vortex.
9. While keeping a vortex going, SLOWLY drizzle in the melted hydrophobic components. It should take at least 3-5 minutes to transfer all of the oils into the water.
10. After about ~5 minutes of blending, place your medium beaker into a larger beaker containing ice water to help cool the liquids and expedite the formation of the emulsion.
11. Mix well for about 15-30 minutes, turning off the stick blender every few minutes to scrape the sides of the container with a spatula  
  
*Do not lift the stick blender above the mixture or else you will make a huge mess, and add too much air to the moisturizer*
12. Once the mixture is efficiently combined, scoop into jars that have been labeled and dated. Add essential oils of your choosing.

### *General Notes*

Please note that we are NOT adding any type of preservative to prevent microbial growth. This means your lotion and or cream might grow some bugs! To help prevent this, you can keep your lotion and cream jar in the fridge.

Lastly, feel free to experiment with different ingredients. I have played around with different oils and waxes with some success (and some failure, but it's always fun!). You can also add things like vitamin E oil (when the mixture has cooled down a bit, but isn't quite yet thickened), green tea powder, or other types of smelly things. There is no right or wrong, so go for it! Trial and error is what science is all about...

### Recipe B Calculations

<b>LOTION RECIPE B</b>			
<i>Raw Ingredient</i>	<i>Percent</i>	<i>For 1 Person (100ml)</i>	<i>For 20 Persons (2000 ml)</i>
Coconut Oil	20%	20g	600g
Apricot Oil	20%	20g	400g
Rosehip Oil	10%	10g	200g
Beeswax	5%	5g	100g
Emulsifying Wax NF	5%	5g	100g
Glycerin	5%	5g	100g
Water	35%	35g	700g
<b>Total</b>	<b>100%</b>	<b>100g</b>	<b>2000g (2000ml)</b>

### Recipe A Protocol

1. Weigh out your **hydrophobic oils** components and add them to a labeled mason jar.

*The hydrophobic oil components are those that are not soluble in water -- Coconut Oil, Almond Oil.*

2. Weigh out the emulsifying agent and add to the mason jar containing oils. Close up the mason jar and put it in the water bath.
3. Weigh out beeswax and place into its own mason jar, put into the water bath.
4. Start boiling the water you will need. As the water is boiling, weigh out the glycerin and add it to beaker.
5. Once the water is boiled, weigh the amount of water needed and add it to the beaker containing glycerin.

6. Prepare your station for creating the emulsion by gathering your emulsion blender.

7. When everything is ready, insert the blender into the water and glycerin mixture to create a vortex.

*If you would like to add a pinch of matcha green tea powder here, now is the time!*

8. While keeping a vortex going, SLOWLY drizzle in the melted hydrophobic components. It should take at least 3-5 minutes to transfer all of the oils into the water.

9. Once you've added the oils into the water, slowly add the melted beeswax.

*The beeswax might solidify as it is being poured -- don't worry, it will incorporate into the lotion mixture!*

10. After about ~5 minutes of blending, place your medium beaker into a larger beaker containing ice water to help cool the liquids and expedite the formation of the emulsion.

11. Mix well for about 15-30 minutes, turning off the stick blender every few minutes to scrape the sides of the container with a spatula

*Do not lift the stick blender above the mixture or else you will make a huge mess, and add too much air to the moisturizer*

12. Once the mixture is efficiently combined, scoop into jars that have been labeled and dated. Add essential oils of your choosing.

### *General Notes*

Please note that we are NOT adding any type of preservative to prevent microbial growth. This means your lotion and or cream might grow some bugs! To help prevent this, you can keep your lotion and cream jar in the fridge.

Lastly, feel free to experiment with different ingredients. I have played around with different oils and waxes with some success (and some failure, but it's always fun!). You can also add things like vitamin E oil (when the mixture has cooled down a bit, but isn't

quite yet thickened), green tea powder, or other types of smelly things. There is no right or wrong, so go for it! Trial and error is what science is all about...