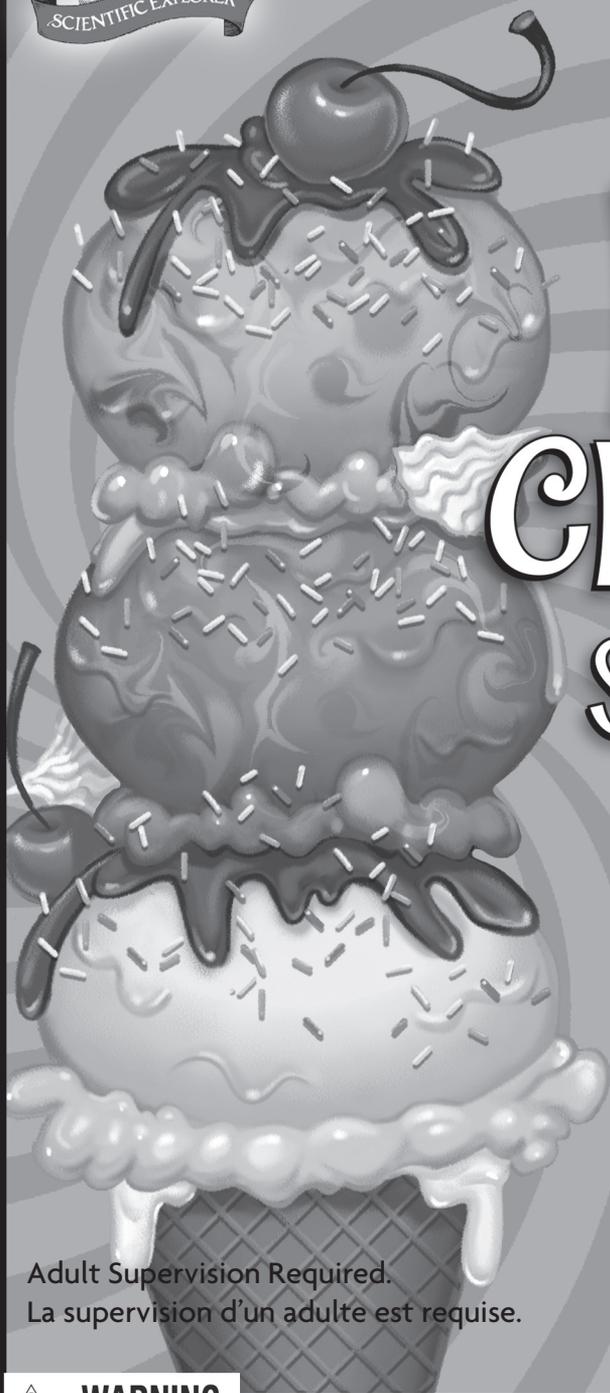




8+

Adult Supervision Required

# ICE CREAM SCIENCE™



Adult Supervision Required.  
La supervision d'un adulte est requise.

 **WARNING:**  
CHOKING HAZARD - Small parts.  
Not for children under 3 years.

## Instructions and more!

# Ice Cream Science

## ACTIVITY GUIDE

Welcome to the Fascinating World of Food Science... and Wondrous Fun!

Where did the idea for ice cream come from? Some experts say that, long ago, the Roman Emperor Nero wanted to end his meals with a cool dessert. He sent slaves up to the mountains to haul snow and ice to his palace. There, Nero's cooks mixed the ice and snow with nectar, fruit and honey. One can only imagine how quickly Nero devoured the new treat.

Of course, you don't need slaves, fancy chefs or a palace to enjoy your own custom-made frozen treats. All the gear that you'll need for making ice cream can be found in this kit, in your kitchen or on the shelves of your local grocery store.

Of course, there's one ingredient that, sometimes, is in short supply. It's called creativity — and only you can provide that!

Are you ready to roll up your sleeves and get started? Good! Let's begin with some easy experiments, then pick up the simple techniques and a few nifty tricks to make desserts fit for a Roman emperor or empress.

Guided by the instructions in this booklet, you'll make enough ice cream to dazzle your family, your friends and yourself. You'll also try your hand at composing a jingle and crafting other marketing materials that will set your ice cream apart from other recognizable brands. The first time through, pay close attention to the recipes. Should you care to try them again, add your own variations and see what happens. You may be pleasantly surprised by the results.

### A few words of caution before you begin:

This kit is intended for children, ages eight and older. Adult supervision is required — ask a grownup friend or relative to assist you with these experiments.

Do not sample the kit's raw ingredients — they must be mixed with milk and other ice cream essentials before they are eaten.

Keep this kit away from small children and pets.

### An Ice Cream Maker's First Rule: Keep It Clean!

Experienced food scientists must follow a set of rules. These rules ensure that any experiment will be conducted safely and achieve the desired results. The most important rule involves sanitation. Simply put, that means keeping everything squeaky clean.

Wash your hands with soap and water before making ice cream.

Before using any bowls, utensils or tools, make sure they are clean and suitable for touching food. Ice cream making can be messy, so wear an apron or clean T-shirt (one that you don't care about) and, if wearing a shirt or blouse, roll up its sleeves. Tie back hair so it doesn't block your view or wind up in your concoctions.

Clean your tools and work area between batches of ice cream.

Reseal each ingredient package after use, keeping the contents clean and fresh.

### What You get in your kit:

Cocoa powder  
Rainbow sprinkles  
Vanilla syrup  
Strawberry syrup  
Measuring spoon  
Pipettes  
Small zipper bags  
Large zipper bags  
Measuring cup  
Ice cream dish  
Lab Sheet

### What You need To get or use:

Milk	Spoon
Granulated sugar (white)	Food coloring
Masking tape (optional)	A partner
Honey (optional)	Salt
2 cups or bowls	Small spoon
Permanent marker (optional)	Lime Juice(optional)
Crushed ice	Cinnamon powder (optional)
Thermometer (optional)	
Pillowcase or T-shirt	
Labels and marking pens	
Paint and brush (optional)	
Faucet or tub for rinse water	
Add-Ins like fruit, decorations or candies (optional)	

## Step 1: Make It Cold... and Colder!

Is crushed ice cold enough to freeze your ice cream? Let's try a couple of experiments and find out.

### What You need from your kit:

2 small zipper  
bags  
Measuring spoon

### What You need To get or use:

Salt  
2 cups or bowls  
Crushed ice  
Thermometer (optional)



## What to Do

### Experiment 1: The Finger Test

1. Fill two cups or bowls halfway with ice (the finer the crushed ice, the better).
2. Put your fingers in the ice to feel how cold it is.
3. In one of the cups or bowls mix four teaspoons of salt into the ice. Don't taste it.
4. Put your fingers in the ice/salt mixture, near the bottom, to feel how cold they are. If you have a thermometer, compare the temperatures of the two cups or bowls.
5. Predict whether the salty and non-salty ice will be the same temperature when you check them later on. Do you think one will be colder? Why?

## Experiment 2: The Freezing Water Test

1. Put one teaspoon of water in each of two small ziplock bags.
2. With your fingers, make a small depression in the ice in each cup or bowl from the previous experiment. Tilt each bag, so that water collects in one of its corners. Put the bags' water-filled corners into the depressions in the ice, and then cover these corners with crushed ice.
3. Let the bags sit, while you do the other activities.
4. Predict what you think will happen to the water in the bags when you check on them later.

## Step 2: Make It Creamy!

The main ingredient in ice cream is some kind of milk from cows or other mammals. Some types of milk have more fat than other kinds do. The more fat in the milk you use, the creamier the ice cream will be. When making ice cream, consider choosing one or more kinds of milk. You can even mix different kinds together. Use the Milky Chart to compare some different kinds. For people who have a hard time digesting lactose (the natural sugar in milk), other products, such as soymilk or rice milk, can be welcome alternatives to cow's milk.

### Cow's Milk

	Cream	Half & Half	Whole Milk	2%	1%	Non-Fat
Fat	Very High (~30%)	Very High (~11%)	High (~4%)	Lower (2%)	Even Lower (1%)	None
Lactose	Yes	Yes	Yes	Yes	Yes	Yes

### Other "Milk"

	Goat	Yogurt	Fish?	Soy, Rice, Almond	Eléphant de mer	Other
	Some people really like it and say it's more digestible.	Made from cow's milk by a bacterium that eats lactose.	But there's no such thing. Fish are not mammals.	Not mammals, but people do use them to make fake milk.	Don't try to milk one!	
Fat	Slightly more than cow's milk, slightly less than human milk.	Varies		Less fat or none.	Super high (54.5%)	
Lactose	Yes	Almost none		NO	Yes	

### What You need from your kit:

Measuring cup  
Ice cream serving  
dish

### What You need To get or use:

1/3 cup of any kind of milk for each batch  
of ice cream  
2 or more cups for mixing or serving

It's fun to make different ice cream recipes at the same time and then compare how they come out. Record any ingredients used on the Lab Sheet on page 12.

## What to Do

1. Put your ice cream-serving cup (or cups) in the freezer so it (or they) will be amply chilled when your ice cream is ready to eat.
2. Measure 1/3 cup of milk and pour it into a mixing cup.
3. Record the kind of milk you used on the Lab Sheet.

## Step 3: Make it Sweet!

More sugar will make your ice cream sweeter. Use sugar sparingly, though, to avoid making it too sweet! You can always add more sugar later, but you can't take out the sugar once it's in!

### What You need from your kit:

Measuring spoon

### What You need To get or use:

Granulated sugar (white)  
Honey or artificial sweetener (optional)  
Cups with milk from Step 2  
Small spoon

## What to Do

1. Using your small spoon, taste a tiny bit of the mixture. Here are some things to think about while deciding how much sugar to add:

Does the mixture taste good to you without extra sugar?

Would you like to sweeten the ice cream mixture with fruit sugar instead of white sugar? If you will be adding berries or other sour fruit, you may want to add more sugar. If you add sweet fruit, such as peaches or cherries, you may want to add less sugar. Our bodies need sugar, but sugar from fruits is healthier for us, because fruits supply other things, such as vitamins and minerals, that our bodies need. Refined sugar does not contain these things. Note: the best time to add fruit to your ice cream is at the end of Step 7.

What about sugar substitutes? If you have an artificial sugar substitute, you can use it instead of sugar. It's sweeter, so you'll need to use less. You could also try honey; however, it can be harder to mix with the other ingredients. As a rule, you will need less honey than sugar.

2. If it's already sweet enough, don't add sugar. If you would like it sweeter, add one teaspoon of sugar at a time and stir, taste testing after each teaspoon until you are happy with the level of sweetness. We recommend not using more than five teaspoons of sugar per batch of ice cream.

3. On the Lab Sheet, write how many teaspoons you added.

4. Repeat the process for each recipe you're making.

### THE COLD TRUTH

Consider this: it takes an average of 50 licks to polish off a single-scoop ice cream cone. That's a lot of exercise for your tongue!

## Step 4: Make it Tasty!

What flavor do you want your ice cream to be? You can make vanilla ice cream, or you can add other flavors. Just be certain that you only add safe ingredients — ones that are approved for humans to eat. You must always check with an adult before deciding to put anything into your ice cream.

### What You need from your kit:

Vanilla and strawberry syrups  
Cocoa powder  
Pipettes

### What You need To get or use:

Cups with milk and sugar (from Step 3)  
Granulated sugar  
Salt  
Lime juice, cinnamon powder or other flavorings you want to try (optional)  
Spoon

## What to Do

### Tongue Tests

1. Put a few grains of sugar on the back of your tongue (not the tip!). Can you taste it?
2. Now put a few grains of sugar on the tip of your tongue. Can you taste it?
3. Do the same with a few grains of salt. If you have lime juice (sour) or unsweetened cocoa powder (bitter), you can do the same thing.

## Ice Cream Science

You have sweet chemical detectors (called taste buds) all over your tongue. There are more of these receptors in some places than in others. Try to find the parts of your tongue that are best for tasting sweetness. If you're like most people, you are naturally attracted to sweet tastes. This attraction to sweets probably helped our ancestors survive, because sweet fruits are richest in vitamins.

Most people don't like bitter tastes — a trait that also may have helped our ancestors survive, because many bitter plants are poisonous. Unsweetened cocoa powder tastes bitter but, of course, it's not poisonous!

### THE COLD TRUTH

Studies reveal that one out of every five ice cream eaters shares their treat with their dog or cat. With this in mind, don't be surprised if Liver or "Tuna-flavored" ice cream becomes the next craze.

Kids have more taste buds than adults. You make new cells that make up taste buds about every 10 days. If you burn your tongue, just wait 10 days to grow new taste buds!

## Flavoring Tests

1. Smell and taste small samples of the flavorings you might want to add. To determine if you really like a flavor, use the tip of your tongue to test sweet flavors.
2. Add one drop of syrup or a pinch of dry flavor to your mixture.
3. Stir in the syrup or dry flavoring and taste a tiny bit of the mixture. If you would like more flavor, add one drop or a pinch at a time, taste- testing the mixture after each one, until you are satisfied. We recommend not more than 5 total drop of flavoring per batch of ice cream.
4. On the Lab Sheet, write how many drops of syrup or pinches of powdered flavoring you added.
5. Repeat these steps with any other flavorings you want to add.  
**Hint:** Many ice creams have some vanilla in them, no matter what the primary flavor may be.

### THE COLD TRUTH

The first ice cream parlor in America opened in New York City in 1776 — the same year that the Declaration of Independence was written and signed. British colonists were the first to use the term “ice cream”. This name came from “iced cream”, which was similar to the then-familiar “iced tea”. It was later shortened to the name we all scream for today.

## Step 5: Make it Colorful!

Now, it's time to add color to your milk mixture. While it won't add flavor, coloring will fool the senses by making the mixture look tasty.

### What You need from your kit:

Lab Sheet  
Pipette

### What You need To get or use:

Food coloring  
Cups or bowls with the mixture of milk, sugar and flavoring from Step 4.

## What to Do

1. Gather whatever food colorings you have in your kitchen cupboard.
2. Think about the color you want your ice cream to be. If it's not a color you have, you may still be able to mix other colors to recreate it. You can practice by mixing colors in a small amount of milk in another cup. If you add too many different colors, you will probably end up with brown.
3. Use pipette to add one drop of food coloring to your mixture. Stir it and decide if you want to add another drop or a drop of a different color.

4. Add one drop at a time, stirring and looking after each addition, until you are satisfied with the color.
5. On the Lab Sheet, write how many drops of each color you added.

## Step 6: Revisit the Ice Cold Experiment!

1. Return to the two cups or bowls of ice you prepared in the earlier experiments.
2. Remove the ziplock bags from both cups and see what happened to the water in them. See? Ice alone is not cold enough to freeze ice cream. Ice mixed with salt is!
3. If you have a thermometer, compare the temperatures of the ice at the bottoms of the two bowls or cups. Which one is colder?

### THE COLD TRUTH

In the 1920's, immigrants at Ellis Island were given vanilla ice cream as the grand finale to their "Welcome to America" meal.

## Ice Cream Science

Under normal conditions, water freezes at 32° Fahrenheit (F) or 0° Centigrade (C). However, dissolved salt lowers the freezing point of water to as cold as -4° F or -20° C. This means that in a freezer, the water can be super-cooled to a point that is colder than regular ice! That's a big science "secret" behind making ice cream.

## Step 7: Make it Smooth!

### What You need from your kit:

2 Large zipper bags  
Small zipper bags,  
one for each recipe  
Measuring cup

### What You need to get or use:

Salt  
Crushed ice  
Your own cups of ice cream mixture, from previous steps  
Pillowcase or T-shirt  
A partner (to hold one end of the T-shirt or pillowcase, as described below)  
Masking tape (optional)  
Permanent marking pen (optional)  
Fruits or chocolate chips (optional)

**Hint:** If more than one person is making ice cream, write initials with a permanent marker on pieces of masking tape and stick them to each small bag. If you write directly on the bags, write gently so you don't puncture the bag.

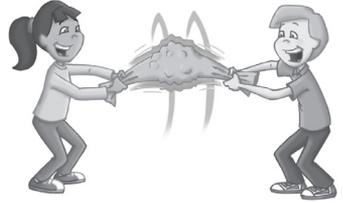
# What to Do

Note: you might want to do this part outdoors, in case of spills.

1. Fill a large ziplock freezer bag about half full of crushed ice. You can fit about four small bags inside a large bag.

2. Measure 1/2 cup of salt, and pour it into the large freezer bag with the ice. Ice isn't an ingredient — it only aids in making the ice cream mixture cold.

3. Write your name or flavor on a small bag. Pour the mixture from the cup into the bag. Have one partner hold the bag open while the other pours in the mixture of ingredients.)



4. Remove most (but not all) of the air, by placing the bag on a table, pressing to push the air out and carefully sealing it. Gently squish the bag and turn it upside down while checking for leaks. Ask an adult to check that the bag is well sealed. If it leaks, use a replacement bag.

Hint: A little bit of air in each bag will help make your ice cream fluffy. If there is a lot of air, it may take longer for the mixture to freeze and your bag may pop open.

5. Repeat this process for other flavors.

6. Put each small bag inside the big freezer bag containing the crushed ice and salt. Make sure the small bags are surrounded by the ice. Carefully seal the big freezer bag. Then put all of this inside another big freezer bag and seal it too.

7. Put the doubled freezer bag inside a pillowcase or T-shirt. Have your partner hold one end of the T-shirt closed, while you hold the other end closed yourself. Then shake the pillowcase or T-shirt back and forth and up and down.

## THE COLD TRUTH

Scientists at several major universities have tried their hands at concocting new, fun flavors of ice cream. Some of these flavors have been immediate hits but many others, including sauerkraut sherbet, dill pickle and mustard, have been flat-out flops.

## More Hints and More Ice Cream Science: Shake, Shake. Shake!

When you first start shaking, the mixtures will not have started freezing yet, so you can shake gently. After a few minutes, check to see if your ice cream is starting to freeze. If it is, it's time to shake hard and fast — especially if you want more air to mix in to make the ice cream fluffy. The shaking helps ensure the ice keeps moving, helping to freeze the entire batch, much like the rotating paddles in an ice cream maker keep scraping ice off the sides of the bucket.

If you freeze your ice cream quickly with lots of shaking, it will have smaller ice crystals in it. Bigger ice crystals make gritty-textured ice cream and smaller crystals make smooth, creamy ice cream.

The more air that's mixed in, the fluffier your ice cream will be. Ice creams with more air are cheaper, because part of what you're buying is air. They also have fewer calories because part of what you're eating is air!

8. Keep shaking the bag without stopping for about five minutes. Check if your ice cream has frozen. If not, keep shaking.

Hint: When your ice cream has frozen, you can add one more spoonful of salt to the ice in the big freezer bag and let your ice cream sit without shaking for 10 to 15 minutes. This will help the ice cream's thickening process.

9. If you want to add fruit to your ice cream, now is the time to do it!

## Step 8: Time to Eat!

You've worked hard and deserve a reward for your efforts. Now it's time to feast on the ice cream you've created and custom-tailored to your own taste preferences!

### What You Need from your kit:

Ice cream serving dish  
Rainbow sprinkles

### What You Need To get or use:

Your newly made ice cream  
Small spoon  
Access to a faucet or tub of rinse water  
Items to add to your ice cream, such as fruits, decorations, sauces or candies (optional)  
Permanent marking pen (optional)

## What to Do

1. When your ice cream is fully frozen, take the small ice cream bags from the salt-and-ice-filled big freezer bag. Before opening your small bags, wipe them with a towel and cold water to remove any salt. Pay special attention to the small area at the very top of each bag, at the seam along which it will open. Salty ice cream tastes awful, so remember to rinse your hands, too.
2. Open your ice cream bag. Fold the top of the bag outward to keep any salt crystals from contacting your ice cream.
3. Take those pre-chilled dishes (from Step 2) out of the freezer and scoop the ice cream into them.
4. If you want, add fruits, decorations, sauces or candies to customize your ice cream.
5. Use your small spoon to dig in — and enjoy!
6. As you eat, ask yourself these questions: How tasty does your ice cream look? How tasty is it?

How does it feel in your mouth (for instance, gritty, smooth, icy, sticky, fluffy, or sweet?)

How does your mouth taste after you've swallowed the ice cream?

How quickly does the ice cream melt?

7. If you made more than one kind of ice cream, compare the kinds. If you have any store-bought ice cream around, compare that with your creation, too.

8. What might you want to change the next time you make ice cream?

HERE ARE SOME OTHER TYPES OF FROZEN DESSERTS SOME TIPS ON HOW YOU CAN MAKE THEM:

GENUINE ICE CREAM - use less milk and add some cream

FROZEN YOGURT - use less milk and add some yogurt

SHERBET - add fruit from a blender to your recipe

SORBET - blended fruit without milk or cream

Try adding a tiny pinch of unflavored gelatin for fluffier and smoother ice cream. You can find additional recipe ideas in books or on the Internet!

## Ice Cream for Sale!

You've come up with a great formula for ice cream. How can you let others know how great it is? The answer is to advertise it.

### THE COLD TRUTH

In 1984, President Ronald Reagan made July National Ice Cream Month and the third Sunday of the month National Ice Cream Day. In his written proclamation, President Reagan called for everyone in the United States to observe these events with "appropriate ceremonies and activities."

#### What You need from your kit:

Lab Sheet  
(for recording your secret ice cream recipe!)

#### What You need To get or use:

Labels and marking pens  
Paint and brushes  
(optional)

## What to Do

1. Start by describing the pleasing traits of your ice cream. How does it taste and smell? Is the flavor strong? What does it look like? Is it fluffy or dense? What kind of animal or plant does the milk come from? Is it low in fats or lactose-free? In other words, what's special about it?

2. Look at some advertisements in magazines or on TV, then create an advertising campaign for your ice cream. Dream up a catchy name, a great slogan, a logo, a jingle — and whatever else you can think of that might attract attention and communicate the greatness of your ice cream!

3. Design a label that's just right for your ice cream. What colors, words or pictures best represent your new product?

**USE THESE RHYMES TO MAKE A RAP OR JINGLE, OR BETTER YET-COME UP WITH YOUR OWN!**

When you're (add a negative adjective) and hot, You want something you haven't got.  
You want my ice cream.

When you're (add a verb)-ing on the street, And you're craving something sweet, You want my ice cream.

It tastes (add a word that describes your ice cream) when you bite it, And (add another word that describes your ice cream) when you bite it, And (add another word that describes your ice cream) so why fight it? In a cone or in a dish, You know (add the name of your ice cream) is your wish, 'Cause you want my ice cream!

(add the name of ice cream) is a mountain of delight.

(add the color of your ice cream) and (texture of your ice cream), It's a beautiful sight.

There's nothing else like it, from north to south. It tastes like (something really nice) melting in your mouth. It's (add a word that describes your ice cream), and (another word that describes your ice cream), so give it a go You don't want (add a negative adjective) Ice cream, you know. It tickles your taste buds and keeps you cool. (Name of your ice cream) is the ice cream that rules. The ice cream of your dreams is here for you. Don't have to eat that (add a word describing a bad ice cream) stuff just 'cause others do Slurp it down! Best one around! To bite or lick, It does the trick! I scream, you scream, we all scream for ice cream!



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**Recipe #1**

**MILK (or milk substitute)**

Kind of milk I used: \_\_\_\_\_

How much milk I used: \_\_\_\_\_

**Sugar (or honey)**

I added: \_\_\_\_\_ teaspoons of sugar.

I added: \_\_\_\_\_ teaspoons of honey.

**Flavoring**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

**Colorants**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I hereby name this ice cream

**Recipe #2**

**MILK (or milk substitute)**

Kind of milk I used: \_\_\_\_\_

How much milk I used: \_\_\_\_\_

**Sugar (or honey)**

I added: \_\_\_\_\_ teaspoons of sugar.

I added: \_\_\_\_\_ teaspoons of honey.

**Flavoring**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

**Colorants**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I hereby name this ice cream

**Recipe #3**

**MILK (or milk substitute)**

Kind of milk I used: \_\_\_\_\_

How much milk I used: \_\_\_\_\_

**Sugar (or honey)**

I added: \_\_\_\_\_ teaspoons of sugar.

I added: \_\_\_\_\_ teaspoons of honey.

**Flavoring**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

**Colorants**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I hereby name this ice cream

**Recipe #4**

**MILK (or milk substitute)**

Kind of milk I used: \_\_\_\_\_

How much milk I used: \_\_\_\_\_

**Sugar (or honey)**

I added: \_\_\_\_\_ teaspoons of sugar.

I added: \_\_\_\_\_ teaspoons of honey.

**Flavoring**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

**Colorants**

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I added: \_\_\_\_\_ drops of \_\_\_\_\_

I hereby name this ice cream