

EXPERIMENT MANUAL

# Lollipop Lab



**WARNING.** Only for use by children 8 years of age or older with continuous adult supervision and assistance. Adult supervision required at all times. Use of a microwave or stove is required. Hot mixtures and stove tops can cause severe burns.

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## Safety information

Warning! Not suitable for children under 8 years. For use under adult supervision. Read the instructions before use, follow them and keep them for reference.

Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 8 years old.

Warning. Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled. Keep the packaging and instructions as they contain important information.

The lollipops must be stored in an airtight container and consumed within one week.

All of the tools should be cleaned by hand before and after use.

## First aid information

Advice in case any accidents should happen during experimentation.

**1. In case of burns:** Wash affected area with plenty of water for at least 10 minutes.

**2. In case of doubt or larger burns,** seek medical advice without delay.

**3. In case of injury (e.g. cuts)** always seek medical advice.

## Safety rules

Read this before starting any experiments.

1. Read these instructions before use, follow them and keep them for reference.

2. Keep young children and animals away from the work area and stove at all times.

3. Store this kit out of reach of children under 8 years of age.

4. Clean all equipment after use. Clean all pots and utensils with hot water and soap.

5. Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.

6. Never work alone. An adult should always be present. Pay attention to the information provided with each experiment.

7. Pay special attention to the quantity specifications and the sequence of the individual steps. Only perform experiments that are described in this instruction manual.

8. The included plastic mold for the lollipops is not dishwasher safe. It will be deformed by high temperatures, so wash it by hand.

9. Clean the work surface carefully after you are finished and always wash your hands thoroughly — before and after you work.

10. If you are allergic to certain foods you must avoid sweets that contain such ingredients. Therefore, always begin by checking the list of ingredients. If you are diabetic, you must only eat the amount of sugar allowed by your diet plan.

11. It goes without saying that there can be no smoking in a confectionery shop.

## Advice for parents and supervising adults

This experiment kit is not suitable for children under 8 years. It must be used with an adult at all times. The kit provides a fun introduction to physical science topics through lollipop-making activities and experiments.

The work of a candy maker is fun and exciting, but it is not always easy. This is why we would like to thoroughly inform you of safety precautions, so that you can guide your child with advice and help. You must supervise and assist him or her with all of the activities in this kit, but especially when using the stove, microwave, and working with hot ingredients. This also applies to the use of sharp knives and other kitchen utensils (e.g. breakable glass).

Take a look through this instruction manual and pay particular attention to the:

- Safety information and rules (inside front cover)
- Safety notes that accompany each experiment (marked with an exclamation point symbol !)
- First aid in case of accidents (inside front cover)

Discuss the individual work steps with your child before beginning. Use only the recommended ingredients.

Candy making requires several different talents and skills. It can be affected by the weather, temperature, and the specific equipment used. Don't get discouraged if a particular step does not work out as expected. Having some experiments "fail" is an important part of science.

Select the working steps that appear suitable for your child and supervise him or her during the heating, pouring, packaging, and storage of the lollipops. Your own lollipops will not keep as long as commercially available lollipops, which are made with professional equipment. Write the production date on the packaging and store in the refrigerator. Make sure that the candies are consumed within one week after they are made.

Tell your child to read these instructions, safety rules, and first aid information, to follow them, to keep them for reference, and to perform only those experiments that are described in the manual.

Pick an area in the kitchen that can tolerate spills and stains. When working with hot pots, have a trivet and pot holders available, and make your child aware of the danger of burns.

To keep the plastic molding tray in good condition, always wash it by hand and not in the dishwasher. The high temperatures used in a dishwasher might deform the plastic tray.

We hope you and your young candy maker have lots of fun with this kit!

**NOTE!** The additionally required items are highlighted in italic script in the individual experiments. Before starting the experiments, carefully read through everything that will be required and make sure to have all the materials ready.

# KIT CONTENTS



- |   |                       |   |   |
|---|-----------------------|---|---|
| 1 | Lollipop molding tray | 5 | Blue raspberry lollipop mix<br>(Net Wt. 50 g/1.76 oz) |
| 2 | Candy thermometer     | 6 | Red cherry lollipop mix<br>(Net Wt. 50 g/1.76 oz)     |
| 3 | Lollipop sticks (20)  | 7 | Beaker  |
| 4 | Ring lollipop base    |   |   |

For the ingredient list, see the side panel on the box.

With this kit,  
you can make:



TO MAKE THE LOLLIPOPS, YOU WILL ALSO NEED: *About 1.5 cups of granulated sugar (300 g/12 oz), heatproof cutting board or work surface, stove or hot plate, small saucepan, oven mitt, water, two metal spoons and a butter knife, bowl of cold water, clean dish towel or paper towel, metal tray or plate lined with parchment paper, time-keeping device (clock, watch, or stopwatch), cup of boiling water (for cleaning)*



## Safety Notes:

Warning! Making lollipops involves heating sugar to very high temperatures. If hot sugar touches the skin, there is a risk of severe burns.

An adult should perform all steps involving the hot sugar.

Everyone (adults and kids) should wear closed-toed shoes while heating the sugar.

Never leave boiling sugar unattended.

- Read all of the instructions carefully before starting.
- Follow the instructions precisely.
- Prepare to work quickly, as the lollipop mixture solidifies after a few minutes
- If the hot sugar mixture cools in the saucepan, it will become very difficult to clean. Carefully use boiling water to clean.

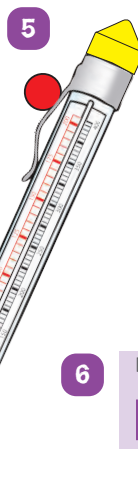
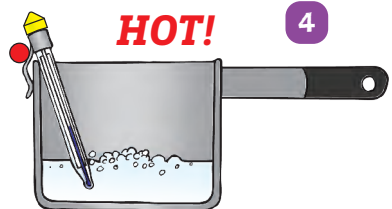
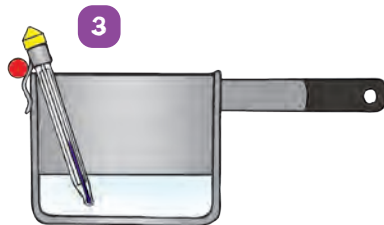
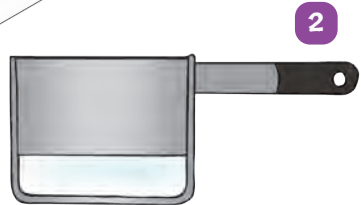
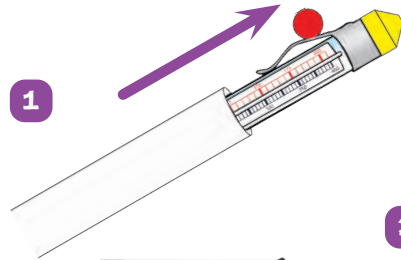
# 1. Calibrating the candy thermometer

## You will need:

- Candy thermometer
- Small saucepan
- Water

## Here's how:

- 1** Slide the candy thermometer out of its protective case.
- 2** Add water to the saucepan so that the water is 1–2 inches deep.
- 3** Carefully slide the metal clip along the thermometer to adjust its position to suit the size of your saucepan. The tip of the thermometer should be beneath the surface of the water, but should not touch the bottom of the saucepan.
- 4** Put the saucepan on the stove or hotplate over medium-high heat and bring to a boil.
- 5** Check the temperature on the thermometer. What temperature do you read on your thermometer?
- 6** **Calibrate** your thermometer. It is known that water boils at 212 °F or 100 °C at sea level. (The boiling point of water is lower at higher altitudes.) Compare the reading of your thermometer to the known value. For example, if your thermometer reads 105 °C in boiling water, you know your thermometer reads 5 °C above the true value.



There are two sets of numbers on your thermometer, representing two temperature scales:

**Fahrenheit (°F)**  
and  
**Celsius (°C)**

To convert from Fahrenheit to Celsius: subtract 32, multiply by 5, and divide by 9.

**6**

Measured value	—	Known value	=	Instrument Error
<input type="text"/>	—	100 °C	=	<input type="text"/>

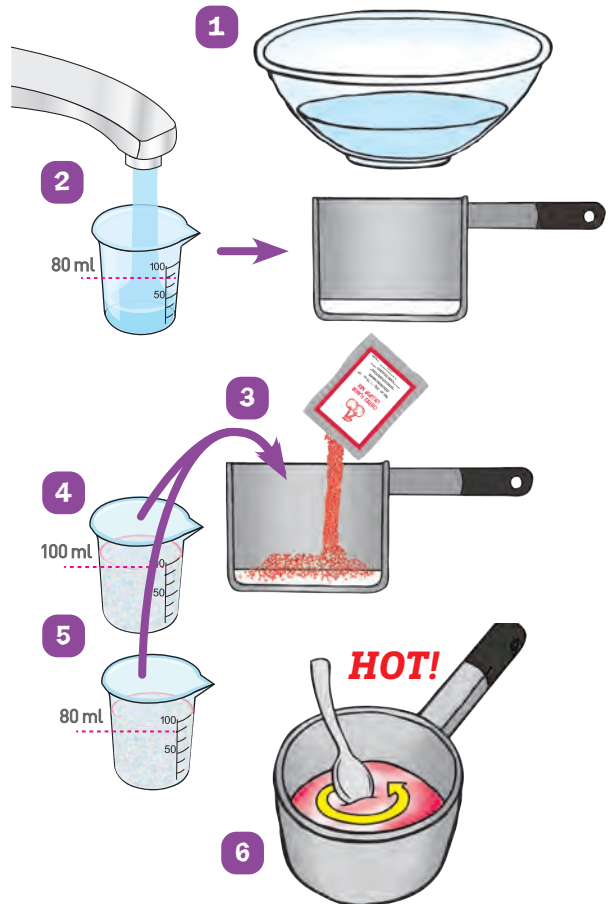
## 2. Make your first batch of lollipops

### You will need:

- Candy thermometer
- One lollipop mix packet
- Lollipop molding tray
- Lollipop sticks
- Heatproof work surface
- Oven mitt
- Large, heatproof bowl
- Small saucepan
- Water
- Time-keeping device
- Two metal spoons and a knife
- Granulated sugar (3/4 cup)
- Metal pan
- Parchment paper
- Cup of hot water (for cleaning)

### Here's how:

- 1 Add cold water to a large, heatproof bowl. The bowl needs to be large enough to fit the saucepan. (It will be used in step 9 to cool the saucepan.)
- 2 Use the beaker to measure 80 ml of cold water. Pour the water into the small saucepan.
- 3 Add one packet of lollipop powder to the saucepan. You can choose to start with either the red or the blue mix.
- 4 Dry the beaker thoroughly using a clean dish towel or paper towel. Then, use the beaker to measure 100 ml of granulated sugar and add the sugar to the saucepan.
- 5 Measure another 80 ml of granulated sugar and add it to the saucepan.
- 6 Heat the saucepan over medium heat on your stove. Use a metal spoon to stir the sugar mixture until all of the sugar has dissolved and the mixture looks clear.



**WARNING!** If the mixture starts to boil, foaming bubbles may rise and overflow. Turn the heat down or remove the saucepan from the heat until the bubbles subside.

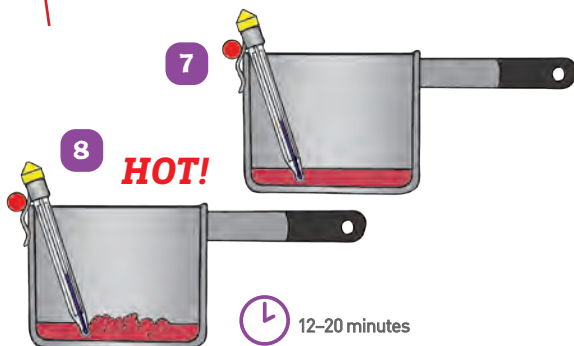


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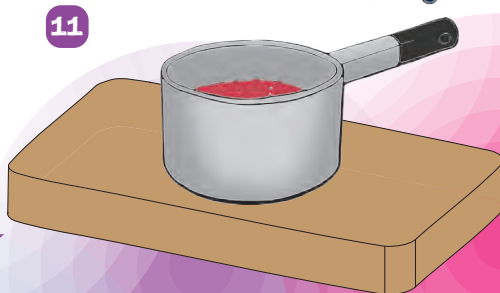
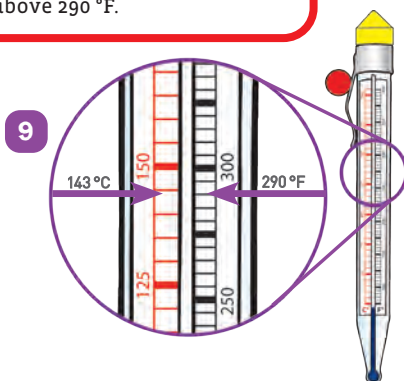
- 7** After all of the sugar is dissolved, clip the thermometer to the side of the saucepan. Slide the metal clip as you adjust the position of the thermometer, so that its tip sits beneath the liquid, but does not touch the bottom of the saucepan.
- 8** Without stirring, continue to heat the mixture until it starts to boil. If it starts to boil over, turn down the heat or remove the saucepan from the heat until the bubbling subsides. Continue heating at a low boil.
- 9** Read the temperature on the thermometer and watch as the temperature increases. Keep watching carefully as the temperature must not exceed 290 °F (143 °C).
- 10** After 12–20 minutes, when the temperature reaches exactly 290°F (143°C), turn off the heat and carefully lower the base of the saucepan into the bowl of cold water to stop the sugar from getting any hotter.
- 11** After a few seconds, take the saucepan out of the water and place it on the heatproof surface or cutting board.

### CAUTION!

In candy making, substances reach extremely high temperatures, which can cause severe burns. An adult must help you at all times. Use oven mitts or potholders.

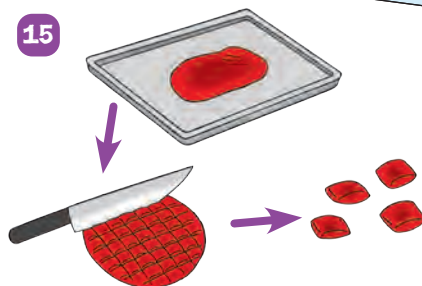
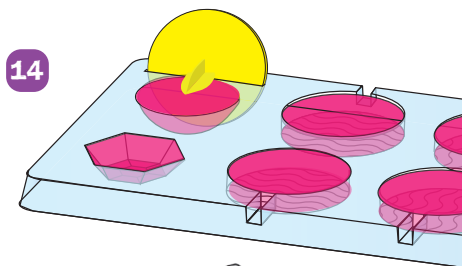
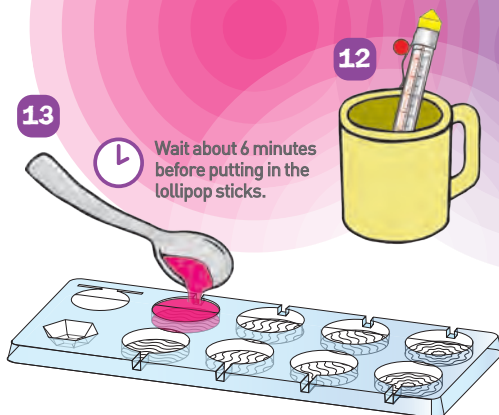


**WARNING!** Do not leave the stove or hotplate unattended. The temperature must not go above 290 °F.

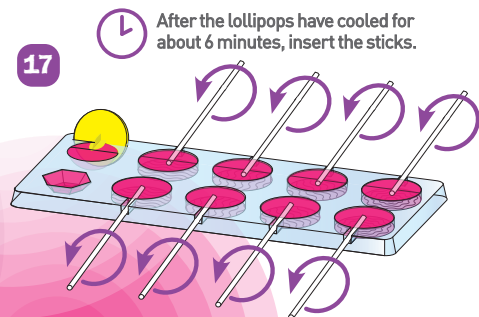


## Here's how it continues:

- 12** Take out the candy thermometer and place it in a cup of hot water to clean.
- 13** Wait until the hot sugar mixture has stopped bubbling before filling the lollipop molds. Use a clean metal spoon to fill the lollipop molds all the way to the top.
- 14** If this is your first batch of lollipops, fill the half-sphere ring lollipop mold and carefully push the ring base into the slot. (If you want to make the single-color gem-shaped pop, put the ring base into the sugar mixture in the gem-shaped mold.) You must wait about six minutes to put the lollipop sticks in the molds, so set a timer, or make note of the time.
- 15** Pour the remaining lollipop syrup onto the tray lined with baking paper. When the candy has cooled slightly, but is still soft, score it with a knife to make a grid pattern. Once cooled, snap the candy pieces along the lines.
- 16** While waiting for the lollipops to cool, start cleaning up. It becomes very difficult to clean the tools once the candy has hardened. Pour boiling hot water into the saucepan and leave the metal spoon and thermometer in the mug of hot water.
- 17** After about six minutes, place a lollipop stick into each slot as shown. Push each stick down into the lollipop mixture, then twist in one direction until the lollipop mixture covers the stick. If the sticks flop down and poke out of the lollipop, repeat the twisting process while the lollipop cools.

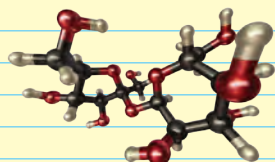


**Safety Note:**  
Caution! High temperatures  
There is a risk of burns.





# What's Happening?



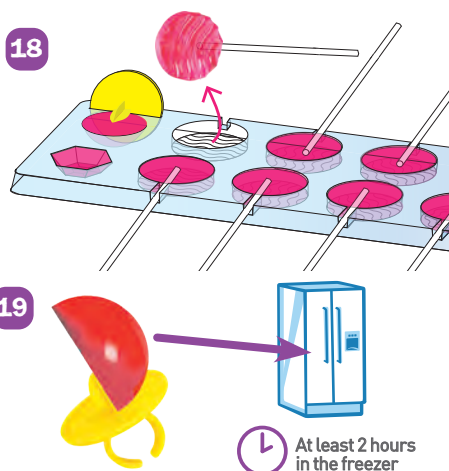
Sucrose molecule

You started with dry sugar, which is made up of granules of sucrose crystals. Transforming these granules into a solid piece of candy begins by dissolving lots of sugar in water. When stirred into water, the granules break apart into individual sucrose molecules. You needed to heat the water because much more sugar can be dissolved in hot water compared to cold water. Once all of the sugar is dissolved, you have a **supersaturated solution**.

Molecules in a supersaturated solution will start to form crystals again if they are bumped or stirred. That's why it's important not to stir the mixture if you want a smooth lollipop. The lollipop packets also contain corn syrup, a starch that helps prevent sugar crystallization.

## Here's how it continues:

- 18** When the lollipops have reached room temperature, carefully remove them from the molds.
- 19** Place the half-finished spherical ring lollipop in an airtight container and put it in the freezer until you are ready to make the next batch of lollipops.
- 20** Store the finished lollipops and hard candy in an airtight container.



**GEEK OUT!**

## WHAT IS THE VOLUME OF YOUR LOLLIPOP?



Volume of a right cylinder:

$$V = \pi r^2 h$$

$V = 9$  cubic centimeters



Volume of a sphere:

$$V = \frac{4}{3} \pi r^3$$

$V = 14$  cubic centimeters

You can use math to calculate the **volume** of your lollipops, so you can know exactly how much space your candy takes up. Each lollipop with a stick is a **right circular cylinder** and the ring lollipop is a **sphere**. These shapes have different formulas for calculating volume.

I'm "pi"

I'm ~ 3.14

Who is  $\pi$ ?

I'm the circumference divided by the diameter of any circle

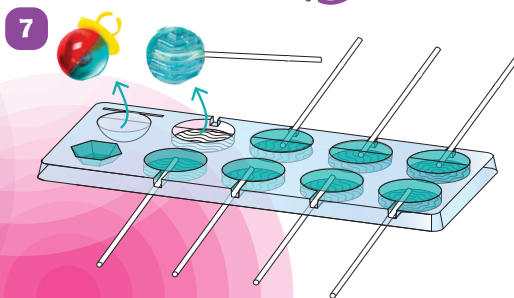
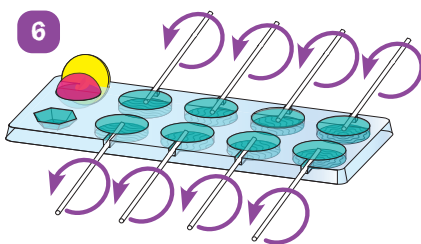
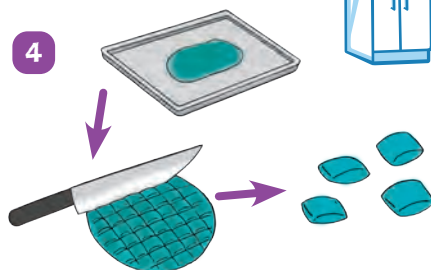
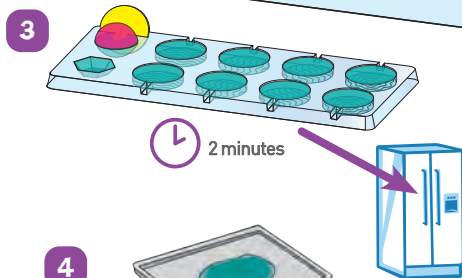
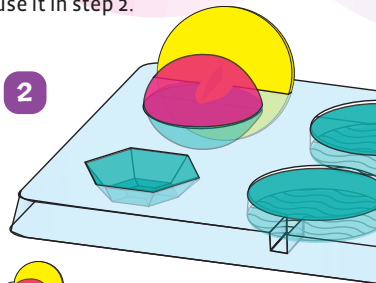
## 3. Make your second batch of lollipops

### You will need:

Everything you needed to make your first batch of lollipops, plus the half-made ring lollipop. Leave the ring lollipop in the freezer until you are ready to use it in step 2.

### Here's how:

- 1** Using the second lollipop mix packet, repeat steps 1–13 from pages 4–6. Keep the half-made spherical ring lollipop in the freezer while you follow these steps.
- 2** Take your half-made spherical ring lollipop out of the freezer and carefully push the ring base into the slot, with the first half of your ring lollipop facing up.
- 3** Immediately place the lollipop tray into the freezer for two minutes.
- 4** Repeat step 15 from page 6.
- 5** Clean up carefully, using boiling water where necessary.
- 6** After the two minutes in the freezer, insert the lollipop sticks, following step 17 on page 6.
- 7** When the lollipops have reached room temperature, carefully remove them from the molds.
- 8** Store the finished lollipops and hard candy in an airtight container and consume within one week.



In cooking and in science, you use many different measurements, but sometimes the units are a bit different. In the United States, we usually use United State Customary Units for cooking measurements. Scientists around the world however have agreed to use the International System of Units (also called the metric system) so that everyone can communicate data more easily. This table helps you convert between the two systems.

## Other Helpful Conversions

1 gallon = 4 quarts =  
8 pints = 16 cups =  
128 fluid ounces

1 cup =  
8 fluid ounces =  
16 tablespoons =  
48 teaspoons

Each batch of lollipops calls for 180 milliliters (ml) of sugar. How many teaspoons is that? First you need to know the **conversion factor**: 1 teaspoon = 5 ml

Now you can use division. What is 180 ml divided by 5 ml? Or in other words, how many times does 5 go into 180? You can represent this visually too.



Temperature	Consistency	Uses
>350 °F >176 °C	<b>Burnt Sugar</b> — turns black, smokes, and smells bad	Should not be eaten
<b>320-330 °F</b> 160-166 °C	<b>Caramel</b> — golden smell like yummy caramel	Caramel, pralines
<b>295-310 °F</b> 146-154 °C	<b>Hard Crack</b> — breaks like glass when cooled	Hard candy, drops, lollipops
<b>270-290 °F</b> 132-143 °C	<b>Soft Crack</b> — elastic strings that will partly break	Taffy, toffee, cream candy, butterscotch
<b>250-266 °F</b> 121-130 °C	<b>Hard Ball</b> — can be formed with wet fingers into a ball	Nougat, gummy candy
<b>244-248 °F</b> 118-120 °C	<b>Firm Ball</b> — easily formed, but still sticky	Chewy candy, marshmallows
<b>234-240 °F</b> 112-115 °C	<b>Soft Ball</b> — can be formed, but will lose its shape again	Fondant (a soft, creamy sugar base for icing)



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