

### Liquid Nitrogen Balloon Demonstration Worksheet

**Safety First!:** Included in the kit are a few latex balloons. If you or a family member have a latex allergy please take necessary precautions.

**Introduction:** Watch the video that shows demonstrations with liquid nitrogen - you will see how temperature impacts how fast gas molecules are moving inside a balloon, following the principles of the ideal gas law. In this activity, you can do an at-home version of the balloon demonstration with liquid nitrogen featured on the video to further test and experiment with what you have learned.

**Martin Lab YouTube Video:** <https://youtu.be/30EbyzmC030>

**Need:**

1. Balloons
2. Space in the freezer
3. A sunny spot
4. Measuring tape or string
5. Sharpie

**Procedure:**

1. Blow up each of the three balloons to about 80% full (or however big you make it so that it can still fit inside of the freezer). Pinch the end before tying off the second and third balloon. Try to make them each the same size.
2. Using a sharpie or soft writing tool label each of the balloons. Mark one as room temperature (RT), one as hot (H) and one as cold (C).
3. Using a piece of string or measuring tape, measure the circumference, or the distance around the center of the balloon where it is widest and mark where you took the measurement on the balloon. It is a good scientific practice to take measurements at least three times to see how repeatable they are and to determine the error. Also make sure to remember units!

*Record each measurement here:*

Start of Experiment Observations				
Balloon	Circumference 1	Circumference 2	Circumference 3	Average
Room temperature				
Hot				
Cold				

- Put the balloon labeled hot into a secure spot that is likely to be in the sun during the experiment. Be sure it is on a surface that is insulated such as plastic or wood. If you are having trouble finding a good spot, consider on the dashboard of a car if the windshield is under the sun. Put the balloon labeled cold into the freezer if possible. If there isn't room, try the refrigerator.
- Set the room temperature balloon in a spot where the temperature is unlikely to change.
- Note the time and set an alarm for an hour.

*Write a hypothesis about what you predict will happen to each of the balloons:*

- After an hour has passed, collect the balloons and put them next to each other.

*Note any observable differences.*

- Find where you marked the circumference and try to repeat the measurement from the same part of the balloons.

*Record each measurement here:*

<b>End of Experiment Observations</b>				
<b>Balloon</b>	<b>Circumference 1</b>	<b>Circumference 2</b>	<b>Circumference 3</b>	<b>Average</b>
Room temperature				
Hot				
Cold				

**Observations / Discussion:**

1. Did what you observed match what you hypothesized would happen?
2. How was this different from what you observed with the liquid nitrogen demonstration?
3. Did the balloons change more or less than you expected? Why?
4. What else would you like for us to freeze in liquid nitrogen? Let us know in the video comments or in an email!