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# Lesson Plan on Particles for 5th Grade

by Christine David

**Standard: 5-PS1-1 Develop a model to describe that matter is made of particles too small to be seen.**

## Engage

- **Phenomena: Watch a short video of quantum theory: https://www.bing.com/videos/search?q=quantem+entaglement+for+kids&&view=detail&mid=FCD39E8E38B868F35517FCD39E8E38B868F35517&&FORM=VRDGAR**
- **Background Knowledge:**
  **Students should know what a particle is. Students should know what matter is. Particles are tiny bits of matter that make up everything in the universe. Matter is the substance of which all material is made.**

| Observable features of the student performance by the end of the grade: | | |
|---|---|---|
| 1 | | Components of the model |
| | a | Students develop a model to describe* a phenomenon that includes the idea that matter is made of particles too small to be seen. In the model, students identify the relevant components for the phenomenon, including: |
| | | i. Bulk matter (macroscopic observable matter; e.g., as sugar, air, water). |
| | | ii. Particles of matter that are too small to be seen. |
| 2 | | Relationships |
| | a | In the model, students identify and describe* relevant relationships between components, including the relationships between: |
| | | i. Bulk matter and tiny particles that cannot be seen (e.g., tiny particles of matter that cannot be seen make up bulk matter). |
| | | ii. The behavior of a collection of many tiny particles of matter and observable phenomena involving bulk matter (e.g., an expanding balloon, evaporating liquids, substances that dissolve in a solvent, effects of wind). |
| 3 | | Connections |
| | a | Students use the model to describe* how matter composed of tiny particles too small to be seen can account for observable phenomena (e.g., air inflating a basketball, ice melting into water). |

- **Teaching Information:**
  **For this lesson, you should split your class into three groups.**
- **Each group will do a center. Each center should take approximately 7 minutes to complete.**
- **Before teaching these rotations, tell students that all information and instruction is in their worksheets. They should read the paper fully before coming to me for questions.**

## Center 1: Balloon Sizes

**Challenge: Which balloon takes contains the most particles? Why? Blow up the balloons to find out and document your answers.**

**Materials Needed: huge balloons, normal size balloons, skinny balloons- must be enough for each student to have one of each type of balloon. Worksheet in appendix 'A'.**

**Learning Documents: science journal, worksheet in appendix 'A': "Balloon Sizes with Particles"**
**Special Directions:**

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- **Have each student glue their worksheet into their science journal. Have them read the directions on the paper, the worksheet in Appendix 'A' will be their guide for this challenge.**
- **In this center, students should work independently. They should not need to ask any questions and should be able to do the project without instruction from me.**

**Brief Explanation of Challenge:**

- **There will be three different types of balloons. Each student will take one of each type of balloon. They will blow up the balloon. If a student cannot blow up balloons, they can either try and see which one would potential take more particles to fill it up, or they could partner up with a person in their group and observe that. After each balloon, students will document their observations and findings into their journal.**

**Formative Assessment:**
**By the end of this center, students will demonstrate their thoughts about particles in balloons by writing their thoughts on the worksheet in Appendix 'A'.**

**Center 2: Baking Soda Balloon**

**Challenge: What kind of matter are you making when you do the baking soda balloon? How do you think the particles are moving? In this challenge you will make a baking soda balloon and write your observations down.**

**Materials Needed: Baking Soda, Vinegar, Empty Water Bottles, Balloons, Measuring Spoons, Funnel {optional but helpful), containers (optional; for easy cleanup) , cut out circle jobs in appendix 'B', bucket for jobs**

**Learning Documents: science journal, worksheet in appendix 'B'.**

**Special Directions:**

- **Each student will first glue their worksheet into their journal. All instructions they need are in their worksheet in appendix 'B'. They should not have questions about the experiment. The one thing that you will need to do before teaching this lesson, is cut out the circles in page 2 of appendix 'B' for jobs.**
- **This lesson will be done as a whole group within their rotation.**

**Brief Explanation of Challenge:**

- **First, they will glue their worksheet into their journal and read their it. They will then choose a job from the bucket. They will read the instructions together. Once they are done, they will create the model themselves following the instructions and doing their jobs. After that, students will answer the questions at the bottom of the worksheet.**

**Formative Assessment: Students will do the center and fill out the worksheet. This will show their thoughts about different types of matter and how particles move.**

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**Center 3: Water Temperatures with Particles**

**Challenge: Do particles change based on water temperatures? Find out by testing cool-aide in different temperatures of water.**

**Materials Needed: three different cups of water, hot water, warm water, cold water, thermometers, cool-aide**

**Learning Documents: science journal, worksheet in appendix 'C'**

**Special Directions:**

- **Students will work with their group to do the experiment. They will need to glue their worksheet into their journal and read the instructions.**
- **All instructions are in their worksheet in appendix 'C'. They should read all the instructions and talk to their classmates before asking me.**

**Brief Explanation of Challenge:**

- **First each student must glue their worksheet into their journal. They will then read the directions together. Each student must fill out the graph.**
- **They will take the temperature of each glass first. Then they will dump cool-aide into each glass and document their observations.**

**Formative Assessment: Students will demonstrate their thoughts and observations of temperature's effect on particles on the worksheet.**

**Big Idea**

**Science Content:**

- **Tell students that everything they can see and touch is called matter. Explain that all matter on Earth exists in the form of a solid, liquid, or gas, and that solids, liquids, and gases are all made of extremely tiny particles called atoms and molecules. Solids, liquids, and gases are all tiny particles, so each thing you see is made up of tiny particles that you can't see.**
- **Matter on Earth is in the form of solid, liquid, or gas.**
- **Solids, liquids, and gases are made of tiny particles called atoms and molecules.**

**Draw the following particles on the board. Have students copy it down in the journal.**

- **In a solid, the particles are very attracted to each other. They are close together and vibrate in position but don't move past one another.**
- **In a liquid, the particles are attracted to each other but not as much as they are in a solid. The particles of a liquid are close together, always moving, and can slide past one another.**
- **In a gas, the particles have very little attraction to each other. They are very far apart compared to the particles in a solid or liquid, and are constantly moving. The particles don't interact with one another but just hit and bounce off of each other when they collide.**
- **In our two balloon centers the bottle has air in it and that air is made up of different gases like oxygen, nitrogen, and carbon dioxide that we breathe every day. Explain that a gas is made up of extremely tiny particles. How do you think**

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**particles move? Watch short clip of particles of a gas- https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/particles-gas-bottle.html**

- **In our water glass center, we got to experience water as a bunch of liquid particles. How do you think they move? Watch short clip of particles of a liquid- https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/particles-liquid-bottle.html**
- **We didn't experience a solid particle, however they are all around us. Can anyone give me an example of a solid? Show short clip of a particle of a solid- https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/particles-solid-hammer.html**

**What are some of the differences you noticed? How does the state of the particle change its interactions? Watch short clip comparing the states of matter- https://www.acs.org/content/acs/en/education/resources/k-8/inquiryinaction/fifth-grade/particles-solid-liquid-gas-diving.html**

**What do you notice now about the particles? Looking back at the centers we used, could you potentially see how those particles reacted by the reaction you got from your experiments? Look at each experiment separately and talk about how the particles' movements changed based on its state of matter.**

**Formative Assessment: Students will take out their marker boards and show the three different ways particles move based on their matter.**

**Learning Supports:**

- **Students who need extra support, can pair up with a classmate. They can also discuss the different centers with each other to get ideas.**
- **For the highflyers, students can go more in-depth into their explanations and think about scenarios that would affect particles. They could also write about their thoughts on the quantum-theory.**

**Wrap-Up Session: Create your own model**

**Challenge: How can you show us unseen particles? Create a model that represents unseen particles. Create and explain your experiment.**

**Materials Needed: water, rocks, bottles, clay, baking soda, vinegar, measuring cups, bowls, paper, thermometer, and other materials that you have lying around the classroom that could work for an experiment.**
***You could also open your cupboards to the class and let them go from there.**

**Learning Documents: Science Journal, worksheet from appendix 'D'**

**Special Directions: This lesson will be taught with the whole class. From there, students will work on their own.**

- **Give students five minutes to explore the materials available to them. Remind them to think about creating an experiment that models unseen particles and thinking about which form of matter they would like to use.**

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- **Write on the board what they should do before they do their experiment:**
    1. **On their 'Purpose' section, students are required to explain what a particle is and the types of matter. They must also tell which form of matter the particle will take on in their experiment. With that, they must draw an example of how the particles would look in a bottle.**
    2. **The hypothesis should be one sentence.**
    3. **The materials should list all things you plan on using.**
    4. **The Procedure section should include at least four steps.**
- **Give students 10- 15 minutes to fill out the four sections above.**
- **After students are done with those sections, they can do their experiment. They will have five minutes for that.**
- **When they are done, have them fill out the results and conclusion about their experiment. This may take 10 minutes. Write the following on the board for the results and conclusion sections:**
    1. **The results should be at least 4 sentences about what happened and if it went the way they wanted.**
    2. **The conclusion should say if the result showed the purpose which was to model unseen particles. You should also talk about the movement of the particles as you went through the experiment. End the conclusion with what you learned about particles. This must be 6 sentences at a minimum.**

**Assessment Plan:**

- **Formative: Each section describes the formative assessment for that center. Most formative assessments will be done through sharing their thoughts in a worksheet. Drawings can be done, and questions will also be asked to assess their knowledge.**

- **Summative: By creating their own experiment and filling out an experiment form explaining their experiment in depth, they will be able to apply and demonstrate their knowledge of particles.**

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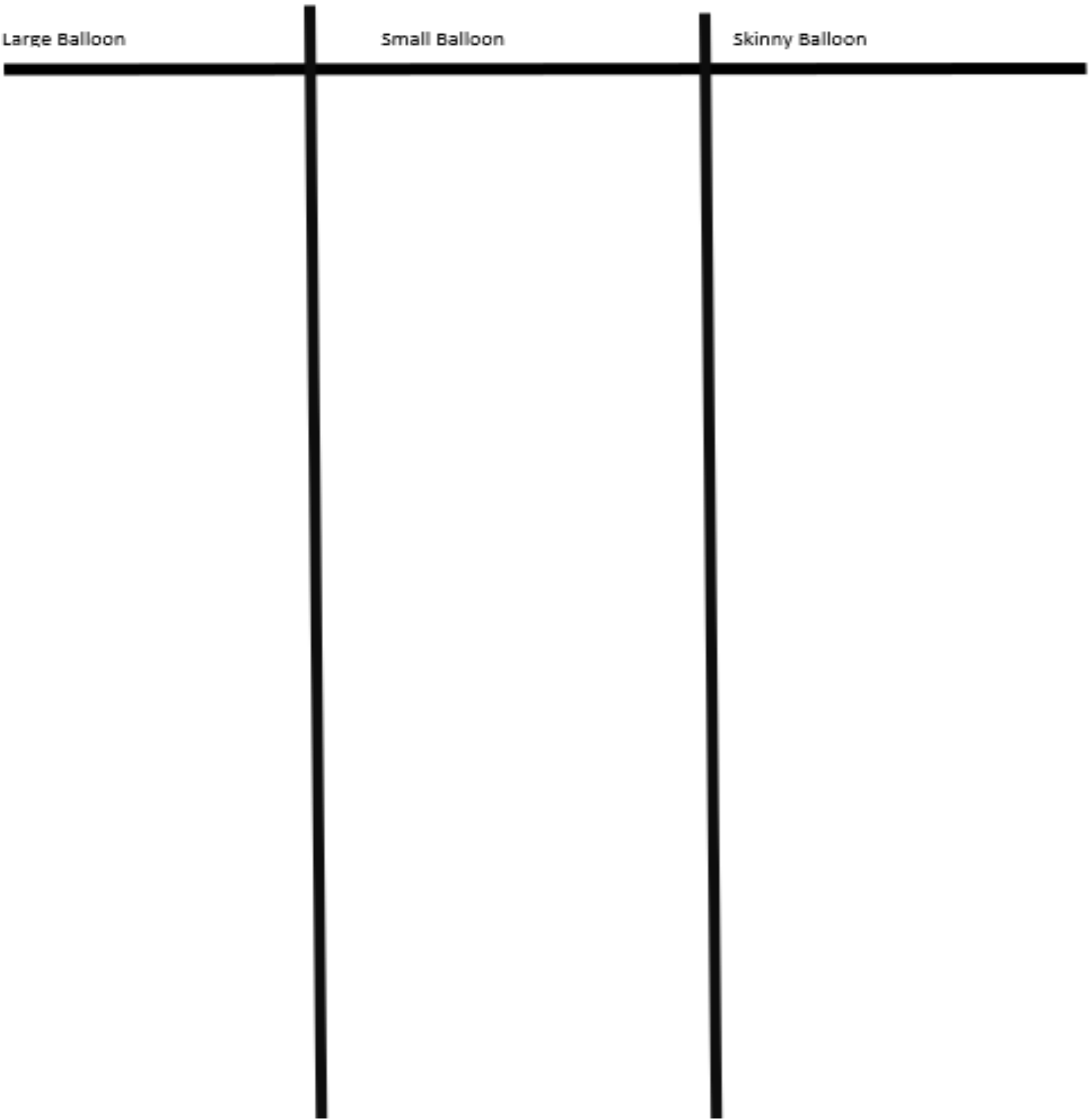
Appendix A

# Balloon Sizes with Particles

**Directions:** Choose a balloon to start with and blow it up. While you blow it up, think of the effort you are using to blow it up. Write your observations below. As you blow it up, does it require more or less particles? Why? Write two sentences in each of the three sections.

* If you can't blow up a balloon, partner up with a classmate and observe them.



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# BALLOON BAKING SODA SCIENCE EXPERIMENT

## Directions:

Glue this into your science journal. You will each have one job. Once you choose a job out of the jar, that is your job. You are not allowed to switch jobs with anyone. Once the experiment is over, you will fill out the bottom half.

## Experiment:

- Blow up the balloon a bit to stretch it out some.
- Use the funnel and teaspoon to add baking soda to the balloon. We started with 2 teaspoons and added a teaspoon.
- Fill the container with Vinegar halfway
- Pinch the balloon so that the baking soda stays in the back.
- Seal the balloon onto the bottle without dumping the soda part in yet.
- Lift up the balloon to dump baking soda into the container of vinegar
- Watch the balloon fill up
- To get the most gas out of it, lightly swirl around the container to get it all going

## Fill Out:

**Observations:** You must answer each question in at least two sentences.

What happened?

Why do you think that?

What kind of matter do you think you created?

How do you think the particles moved during the experiment?

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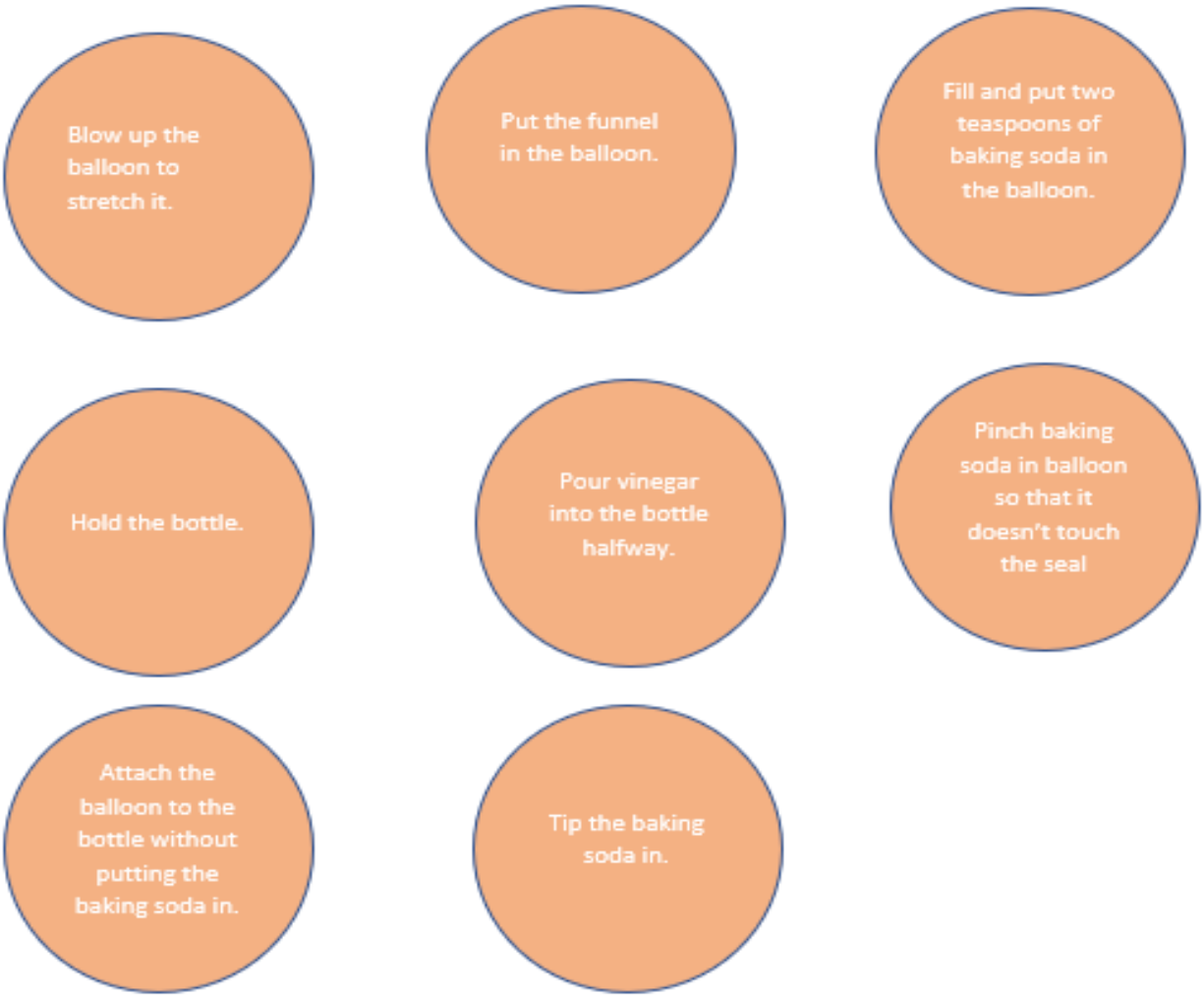
Blow up the balloon to stretch it.
Put the funnel in the balloon.
Fill and put two teaspoons of baking soda in the balloon.
Hold the bottle.
Pour vinegar into the bottle halfway.
Pinch baking soda in balloon so that it doesn't touch the seal
Attach the balloon to the bottle without putting the baking soda in.
Tip the baking soda in.

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Appendix C

# Particles in Water

**Directions:**

1. Take the temperature of each glass of water. Document it in the log below. Make a hypothesis. What do you think will happen to the cool-aide when it goes into each of the waters? Write your answer in the coordinating column.
2. Pour cool-aide into the hot water. What actually happened when you put the cool-aide in the water? Document it.
3. Now poor the cool-aide into the cold water. What actually happened when you put the cool-aide in the water? Document it.
4. Pour cool-aide into the warm water. What actually happened when you put the cool-aide in the water? Document it.
5. Why do you think it happened that way? Write your answers in the corresponding columns.

| | Hot Water | Cold Water | Warm Water |
|---|---|---|---|
| Temperature | | | |
| Hypothesis | | | |
| What happened? | | | |
| Why do you think that happened? | | | |

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Appendix D

# Experiment:

**Purpose:** I wonder...

**Materials:**

**Hypothesis:** I think...

**Procedure:**

**Results:**

**Conclusion:** I learned that...