

Fifth Grade Physical Science

UNDER PRESSURE: Matter and Its Interactions

Background Information:

Air pressure, or atmospheric pressure, is the force exerted on objects by the atmosphere. Barometers are typically used to measure atmospheric pressure. Made of a liquid filled glass tube, the level of liquid will rise when the pressure increases and fall when the pressure drops. Lower barometric pressure tends to be associated with precipitation and cloudiness, while higher readings are related to sunshine and calmer weather. Air is made of invisible particles. The density of these particles is affected by atmospheric pressure. The greater the pressure, the more densely packed the particles are. In comparison, less pressure means a lower density of air particles. While the particles are too small to be observed, the effects of the particles and changing their density are often visible.

Everything is made of matter, which is composed of atoms. Atoms are too small to be seen with the human eye. Matter has volume and mass. Mass refers to the amount of matter in an object. Volume will be affected by pressure changes, whereas mass will not.

Performance Expectation

PS1-1 Matter and its Interactions: Develop a model to describe that matter is made of particles too small to be seen.

<https://www.nextgenscience.org/pe/ms-ps1-1-matter-and-its-interactions>

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter: Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

Science and Engineering Practices

Developing and Using Models: Develop a model to predict and/or describe phenomena.

Crosscutting Concepts

Scale, Proportion, and Quantity: Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Materials:

- Student Pages
- Mini-marshmallows (fresh)
- 10 mL Syringe
- Marker
- Ruler

- Wipes/Sink for Cleanup
- Hand Lenses

Suggested Implementation:

Engage students in a discussion about marshmallows. The following may be starting points:

- **What foods contain marshmallows?**
- **Why do you think marshmallows are used in food?**
- **What ingredients are in marshmallows?**
- **What else do you know about marshmallows?**

Help students find groups of two to three. Distribute Student Pages.

Assist students as needed in their examination and recording observations of a few marshmallows. Encourage the use of a hand lens and ruler to assist in making observations. (If needed, you may wish to have a class discussion about the types of observations that could be made.)

Distribute a syringe to each group. Ask the class what they notice about the syringe. Allow time for groups to explore and practice using the plunger and barrel. Encourage groups to hold a finger on the tip opening and push/pull the plunger. Groups can share what they noticed.

Now that students are familiar with using the syringe, distribute a few more marshmallows to each group. You may wish to have them draw a line segment from the top to the bottom of the marshmallow. This may be a helpful visual reference for students as they complete their exploration. Groups will place a marshmallow in a syringe, push the plunger down until it is touching the marshmallow. Note, the marshmallow should not be squished. Next students will hold their finger over the tip opening and manipulate the plunger. As students investigate, observations should be recorded. Drawings are encouraged.

Debrief:

Once groups have completed their observations, pull the class together for discussion of the following:

- **Summarize your data.**
- **Based on your data, what patterns did your group notice?**
- **What patterns did the groups have in common?**
- **What happened to the marshmallow when the plunger was pulled up?**
- **Why did this occur?**
- **What happened to the marshmallow when the plunger was pushed down?**
- **Why did this occur?**
- **Are we able to see the air in the marshmallows?**
- **If air can't be seen, then how do you know it was in the marshmallows?**

- **What other items/products contain air? What evidence do you have?**

Assessment:

The following single point rubric can be used to assess student understanding. For each of the four criteria listed below, either circle the proficient description or add notes to a box indicating why the student’s performance was either lacking or exceptional.

Areas that need improvement. Developing Performance	Criteria for Proficient Performance	Evidence of exceeding standards. Advanced Performance
	Explained that air particles are too small to be seen, but the effects are visible.	
	When asked “How do you know?” students referenced observations from their own investigations.	
	Explained that materials are made of different sized particles.	

Accommodations

The plungers can be difficult to move. Students with difficulty can be paired with an appropriate partner.

Materials

Marshmallows should be fresh.

Kitchen basters such as a turkey baster may be used. (Results will be similar, but not as dramatic.) In this case, larger marshmallows should be used. Check the diameter of the marshmallow and barrel to make sure the marshmallow will fit.

Syringes may be purchased from science supply vendors, such as Arbor Scientific or Flinn Scientific.