Bell Jars

Mid-Valley
STEM-CTE HUB

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Bell Jars

The Bell Jars STEAM Kit provides a hands-on way for students to explore air pressure, volume, and gas behavior using mini vacuum chamber experiments. Each of the 15 sets includes a bell jar lid and base, balloon, syringe, tubing, and marshmallow, allowing students to see how air behaves under different pressure conditions. From expanding balloons to growing marshmallows in a vacuum, this engaging kit helps visualize invisible scientific concepts and supports inquiry, data collection, and evidence-based conclusions.

Grade Level

4th - 10th

Group Size

2 - 3 students per group

Time Duration

30 - 60 minutes

Content of Kits

Components

- 15 Activity guides
- 15 Bell jar sets
  - Bell jar and base
  - Balloon
  - Tubing
  - Syringe
- Marshmallows

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Usage

Getting Started

1. **Introduce the Concept of Air Pressure -** Begin with a simple demonstration or video showing how gases expand and contract under changing pressure.

2. **Review Kit Components -** Show students each part—bell jar, syringe, tubing, balloon, and marshmallow—and explain how they work together.

3. **Demonstrate the Setup -** Walk through how to connect the tubing to the syringe and bell jar, and how to draw air out to simulate a vacuum effect.

4. **Discuss Safety and Handling -** Emphasize gentle handling of the bell jars and slow, even use of the syringes to avoid damage.

5. **Assign Roles in Small Groups -** Roles like operator (controls syringe), observer (records visual changes), and recorder (logs data) keep everyone engaged.

Storage

- Disassemble each set and put components back in the bags they came in. Store all kits in the bin provided.

Troubleshooting

- **Syringe Doesn't Create Vacuum -** Ensure the tubing is tightly connected at both ends and that there's no air leakage around the bell jar seal.
- **Balloon or Marshmallow Doesn't Expand -** Check that the system is sealed properly and that the syringe is being drawn back slowly and steadily.
- **Tubing Becomes Disconnected -** Secure tubing with small rubber bands or use slightly moistened connections to improve grip.
- **Jar Fogging or Hard to See Inside -** Wipe jars clean between uses and store them dry to prevent residue or moisture buildup.

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Activity Guide

Beginner

Marshmallow in a Vacuum
Students place a marshmallow inside the bell jar and slowly pull back the syringe to reduce air pressure. As the marshmallow expands, students discuss how trapped air responds to the vacuum, introducing the basics of pressure and gas volume.

Intermediate

Balloon Behavior Test
A partially inflated balloon is placed in the bell jar. Students observe what happens when air is removed and then slowly let back in, recording the balloon's expansion and contraction. This reinforces understanding of gas laws and the relationship between volume and pressure.

Advanced

Design a Controlled Experiment
Students design an experiment to test how size or material affects expansion in a vacuum (e.g., comparing small vs. large marshmallows, or balloon brands). They form hypotheses, conduct controlled tests, collect data, and present results with conclusions.

Extension Activities:

Vacuum Chamber Comparisons
After completing bell jar tests, students research real-world uses of vacuum chambers in industries like aerospace, food packaging, or medicine. They create a short presentation or infographic showing how controlling air pressure is essential in professional contexts.

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Learning Extensions

STEAM Connections: Science

Learning Objectives:

- Demonstrate how air pressure affects the volume of gases in a closed system.
- Conduct experiments to observe changes in matter when atmospheric conditions change.
- Apply scientific reasoning to explain phenomena like expansion, compression, and vacuums.
- Collect and analyze observational data to form evidence-based conclusions.
- Use the scientific method to test variables and refine experimental procedures.

Career Connections:

- **Aerospace Engineer –** Designs spacecraft and equipment that operate in low-pressure environments.
- **Atmospheric Scientist –** Studies air pressure, weather systems, and climate behavior.
- **Mechanical Engineer –** Develops systems involving pneumatics and pressure control.
- **Food Scientist –** Uses vacuum sealing to preserve freshness and prevent spoilage.
- **Medical Technician –** Works with vacuum systems in devices like suction tools and oxygen delivery systems.

Essential Employability Skills:

- Critical Thinking
- Collaboration
- Observation
- Communication
- Curiosity & Inquiry

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Resources and Accessibility

Safety Guidelines

- **Avoid Overpressurizing -** Instruct students not to pull the syringe past its limit, as this can create seal failure or damage to the setup.
- **Clean and Dry After Use -** Wipe jars and parts dry before storing to avoid mold, residue, or slipping hazards.
- **Handle Bell Jars with Care -** Bell jars should be placed gently on flat surfaces and never forced into position—cracks or chips can create hazards.
- **Supervise Syringe Use -** Students should use slow, even pressure when drawing or releasing the syringe to avoid sudden pressure changes or damaged tubing.

Accessibility

- **Flexible Roles in Groups -** Assign students as observers, data recorders, or narrators based on comfort and accessibility needs.
- **Use Visual Demonstrations First -** Show a live or video demo before hands-on time to support students who benefit from visual previews.
- **Offer Pre-Assembled Setups -** For students with motor difficulties, provide setups with tubing already connected or allow them to observe and record while peers operate.

Library Catalog

Library Resources

Feedback

QR to feedback survey