

Learning-Focused Lesson Plan

Name: Allison White

Topic: Intro Lesson to Boyle's Law 7th Grade

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| Learning Goals for this Lesson Students will understand the relationship between pressure and volume of gases. | Standards: 7.6 Matter and Its Interactions, Create and interpret models of substances whose atoms represent the states of matter with respect to temperature and pressure. |
| Students Will Know: <ul style="list-style-type: none">that air is made up of a mixture of atomsClassify matter as pure substances or mixtures based on compositionsBasic understanding Lab Quest and Vernier Gas Pressure Sensor | Students Will Be Able To: <ul style="list-style-type: none">determine the relationship between the pressure and volume of a fixed amount of a confined gas at a constant temperature.Students will be able to |
| Lesson Essential Question How does volume affect the behavior of atoms? | |
| Lesson Materials: <ul style="list-style-type: none">-mini marshmallows-syringe & plunger-Gas Pressure Sensor (TTU Lending Library)-Lab Quest (TTU Lending Library)-Air-Introductory Note Taker | |
| Lesson instruction | |
| Learning Activity 1: Activating Strategy: Students will participate in the introductory lesson for the unit on gases. The first activity will be a group activity where they will need the following items: <ul style="list-style-type: none">-one mini-marshmallow-one syringe with one plunger Place students in partners and have them complete the following in order <ol style="list-style-type: none">1. Place the marshmallow in the syringe2. push the plunger down just until it touches the top of the marshmallow (this is compressing the marshmallow)3. Put your finger over the tip of the syringe to form a seal and then pull up on the plunger.4. They need to answer the questions on their Note Taker<ol style="list-style-type: none">a. What happens to the marshmallows?b. What is being decreased inside the syringe?c. What is being increased?5. Now students will need to take their finger off the tip of the syringe.6. Pull the plunger to the top of the syringe.7. Seal the tip with your finger again and push the plunger down8. They need to answer the following questions in their note taker<ol style="list-style-type: none">a. What happens to the marshmallows?b. What is being decreased inside the syringe?c. What is being increased?d. Who's law is this??? (We will tell them Boyle's) | Graphic Organizer <ul style="list-style-type: none">-Introductory Note Taker- |

Assessment Prompt for LA 1

Active engagement and participation in classroom discussion will be the assessment for this portion of the lesson.

Learning Activity 2: Pressure-Volume Relationship in Gases (Plan for a day to just teach the students how to use the gas sensor and the lab quests)

Based on the inquiry lab, the students will understand the relationship between the gas pressure and volume.

With their partner, the students will complete the following steps in order, we will go over and through as a class to ensure that everyone is on the same page.

1. Connect the Gas Pressure Sensor and an air sample for data collection
 - a. connect the Gas Pressure Sensor to the LabQuest and choose NEW from the file menu.
 - b. Move the plunger of the syringe until the front edge of the inside black ring is positioned at the 10 mL mark. (Check Class before moving on)
 - c. Attach the 20 mL syringe to the valves of the Gas Pressure Sensor. (Check Class)
2. Set up the data-collection mode.
 - a. On the Meter screen, tap Mode. Change the mode to Events with Entry.
 - b. Enter the Name (Volume) and Units (mL). Select OK.

This is the tricky part

3. Students will be instructed to adjust volumes by .8 to account for the gas pressure sensor. The teacher will fill out this portion of the chart for them to lessen confusion, and will explain the reasoning behind this.
4. They are ready to collect pressure and volume data! It is easier for 1 person to take care of the gas syringe and the other to enter the volume.
 - a. Start Data Collection- add to their note taker
 - b. Have the students move the plunger to 5.0 mL on the syringe. Hold the syringe firmly in this position until the pressure value displayed on the screen stabilizes. Record value.
 - c. Tap Keep and enter 5.8, the gas volume, (in mL) on the screen. Remember you are adding 0.8 mL to the volume of the syringe for the total volume. Select OK to store this pressure-volume data pair.
 - d. Repeat this procedure for the following syringe volumes, 10.0, 12.5, 15.0, 17.7, and 20.0 mL.
5. When you have completed the data collection, a graph of the pressure vs. volume will be displayed. Have students draw what their graph looks like in their note-taker.
6. Based on the graph of pressure vs. volume, decide what kind of mathematical relationship exists between the two variables, volume and pressure. You can do this as a whole class, or group

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| <p>by group, however fits the needs of the class. (Mathematical expression=pressure x volume = constant)</p> <p>7.</p> | |
| <p>Assessment Prompt for LA 2: Completed Note Taker & Class Discussions</p> | |
| <p>Summarizing Strategy At the end of their note taker the students will be responsible for summarizing the relationship that volume has on the air around them? (This is basically a summary of what we just discussed in this inquiry based lab. This is an introductory lesson, so the teacher will be very lenient on their responses.)</p> | |

Intro to Pressure Lab

Name: _____ Partner's Name: _____ Class: _____

Essential Question: How does volume affect the behavior of atoms?

MARSHMALLOW FLUFF INTRO

Materials Needed:

- one mini-marshmallow
- one syringe with one plunger

Directions: You will be working with your partner to complete the intro lab and how pressure can affect the marshmallow. Please take notes on your note taker!

1. Place the marshmallow in the syringe.
2. push the plunger down just until it touches the top of the marshmallow.
3. Put your finger over the tip of the syringe to form a seal and then pull up on the plunger. (IF YOU ARE HOLDING YOUR FINGER ON THE SYRINGE DO NOT TAKE IT OFF)

What happened to the marshmallow?

DRAW THE MARSHMALLOW IN THE SYRINGE HERE:

What is being decreased inside of the syringe?

What is being increased?

4. Now take your finger off the tip of the syringe.
5. Pull the plunger to the top of the syringe.
6. Seal the tip with your finger again and push the plunger down

What happened to the marshmallow?

DRAW THE MARSHMALLOW IN THE SYRINGE HERE:

What is being decreased inside of the syringe?

What is being increased?

Whose law is this?

Part 2: LabQuest Experiment

Materials Needed:

- Gas Pressure Sensor (TTU Lending Library)
- Lab Quest (TTU Lending Library)

Directions: You will continue working with your partner for this portion of the lab. You will need to pick one person to work the syringe and the other person to work the lab quest. Please follow the instructions and wait for the class.

Step 1: Connect the Gas Pressure Sensor and an air sample for data collection

- a. connect the Gas Pressure Sensor to the LabQuest and choose NEW from the file menu.
- b. Move the plunger of the syringe until the front edge of the inside black ring is positioned at the 10 mL mark. (Check Class before moving on)
- c. Attach the 20 mL syringe to the valves of the Gas Pressure Sensor.

Step 2: Set up the data-collection mode.

d. On the Meter screen, tap Mode. Change the mode to Events with Entry.

e. Enter the Name (Volume) and Units (mL). Select OK.

f. **RAISE YOUR HAND AND HAVE YOUR TEACHER CHECK BEFORE MOVING ON.** _____

Step 3: For this lab, we are adding 0.8mL to all of the air within the gas pressure sensor. No worries. I have updated your lab chart so you do not have to forget! ;)

Step 4: It is DATA collection time!! Follow the instructions and complete the chart.

g. Start Data Collection- add to their note taker

h. Have the students move the plunger to 5.0 mL on the syringe. Hold the syringe firmly in this position until the pressure value displayed on the screen stabilizes. Record value.

i. Repeat this procedure for the following syringe volumes, 10.0, 12.5, 15.0, 17.7, and 20.0 mL.

Data and Calculations

| Volume (mL) +0.8mL | Pressure (kPa) This comes from the Lab Quest) | Constant, k |
|--------------------|--|-------------|
| 5.0 mL | | |
| 10.0 mL | | |
| 12.5 mL | | |
| 15.0 mL | | |
| 17.5 mL | | |
| 20.0 mL | | |

DISCUSSION QUESTIONS

1. If the volume is doubled from 5.0mL to 10.0mL, what does your data show happens to the pressure?

2. If the volume is halved from 20.0mL to 10.0mL, what does your data show happened to the pressure?

3. If the volume is tripled from 5.0mL to 15.0mL, what does your data show happened to the pressure?

4. Based on your data, what would you expect the pressure to be if the volume of the syringe was increased to 40.0mL? Explain.

5. Based on your data, what would you expect the pressure to be if the volume of the syringe was decreased to 2.5mL?

6. To see if there are relationships between pressure or volume, you can do simple mathematical calculations. Try multiplying or dividing your values. Which method gives you a fairly, or closely related value? We will call this constant, k.

7. How constant were the values for k you obtained in Question 8?

8. Using P, for pressure, and V, for volume, and k, for the constant, write an equation representing Boyle's law. USE YOUR DATA SHEET.

Write a verbal statement that correctly expresses Boyle's law.