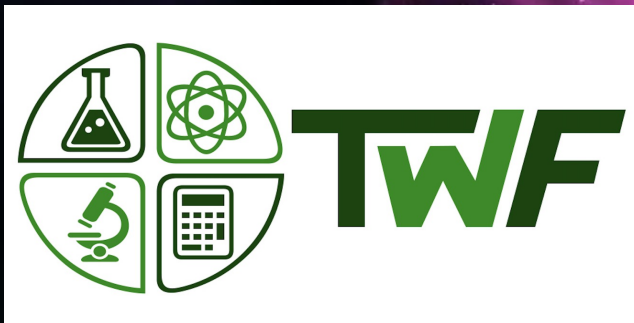


# Pressure, Volume, and Temperature

## 5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



# Complete Teacher Instructions

## Pressure, Volume, and Temperature 5E Lesson

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------|
| Grades 8-11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Pressure, Volume, and Temperature | Ongoing Lesson |
| <b>Lesson Objective:</b><br>Students will learn about: <ul style="list-style-type: none"> <li>• Gases</li> <li>• Gas Properties</li> <li>• Boyle's Law</li> <li>• Charles' Law</li> <li>• Gay-Lussac's Law</li> <li>• Avogadro's Law</li> <li>• Ideal Gas Law</li> <li>• Hot Air Balloons</li> <li>• Weather Balloons</li> <li>• Refrigeration</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                |
| <b>Possible Student Misconceptions:</b> <ul style="list-style-type: none"> <li>• Gases are not matter</li> <li>• Gases have no mass</li> <li>• Air is not a gas</li> <li>• Air particles are not moving when there is no wind</li> <li>• Air does not take up space</li> <li>• Gases have negative weight</li> <li>• There is no pressure around us because we can't feel it</li> <li>• When a gas expands, the particles get larger</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |                |
| <b>Materials:</b> <ul style="list-style-type: none"> <li>• 1 device (smartphone, Chromebook, laptop, tablet, or computer) per 3 stu</li> <li>• A means of projecting a PowerPoint presentation</li> <li>• Internet access</li> <li>• General classroom objects</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                |
| <b>Teacher Notes:</b> <ul style="list-style-type: none"> <li>➢ All videos can be accessed directly from the PowerPoint. To retrieve them icon while in slideshow mode and it will automatically open for you. If it do reason, right-click on the image and click <b>Edit Hyperlink</b> or something sin</li> <li>➢ I've created a video walkthrough if needed. It can be accessed here - <a href="https://youtu.be/oCIKIP9SaDQ">https://youtu.be/oCIKIP9SaDQ</a></li> <li>➢ I don't believe in long lessons. If you feel your students are losing their foc Stop the PowerPoint and give them a 5-minute break. If you'd like to show recommend my video collection here - <a href="http://www.teachwithferqy.com/sci">http://www.teachwithferqy.com/sci</a> are tons of brain-break videos to choose from all grouped by category.</li> </ul> |                                   |                |

## Pressure, Volume, and Temperature –

### Engagement Phase

Your students will watch the video 'Gas Laws' and complete the questions found in the file – [Engagement – Gas Laws Video](#).

#### Teacher Notes:

- The video is about five minutes long
- You may need to show the video more than once or pause when an answer is given to one of the questions.

### Exploration Phase

#### Exploration – Lab Station Activity

- In groups of 2-3, have your students complete [Exploration – Lab Station Activity](#). Once they're done, they will submit their passport to you.

#### Teacher Notes:

- The complete instructions for my Lab Station activity can be found in the [START HERE – Instructions](#) file.

### Explanation Phase

#### PowerPoint Lessons

- The lesson is found in the folder – [Explanation – Lesson](#)
- This lesson is designed to be completed over one day
- There are multiple embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson

- The lesson covers the following topics:

- Gases
- Gas Properties
- Relationships
- Boyle's Law
- Charles' Law
- Gay-Lussac's Law
- Avogadro's Law
- Ideal Gas Law

#### Teacher Notes:

- All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select **Edit Hyperlink** or something similar.
- I've created a video walkthrough if needed. It can be accessed here - <https://youtu.be/oCIKIP9SaDQ>

- I have also enclosed a .PDF version of both the teacher and student versions.

### Elaborate Phase

#### Elaborate – Reading

Your students will complete – [Elaborate – Hot Air Balloons](#). This reading will require your students to move beyond what was covered directly in the lesson and allow them to further develop their understanding.

#### Teacher Notes:

- Students will work individually or in small groups
- This reading contains 8 comprehension questions and 3 extension questions. It is fully editable so I encourage you to remove any question(s) in order to meet the needs of your students as well as your time frame.

### Evaluate Phase

#### Quiz

Have your students complete – [Evaluate – Pressure, Volume, and Temperature Quiz](#)

#### Teacher Notes:

- It's sometimes best to have the students peer evaluate
- Placing students in small groups and having them exchange papers to mark will accomplish two things
- 1) Provide immediate feedback on the questions they just completed
- 2) Significantly reduce your marking time
- Peer evaluation is not needed, only suggested when appropriate

Duration: 1 hour

Teacher Role – Facilitate learning and keep students focused

#### Goal

- ☐ Students use their newly obtained knowledge to propose solutions and extend their learning to new situations

Duration: 30 min

Teacher Role – Distribute and collect evaluation

#### Goal

- ☐ Students are given the opportunity to demonstrate their understanding and evaluate their own progress

connect the content presented to previous experiences

# Each phase is clearly described

# A Complete Lesson

## Gas Properties

- Pressure: impact of molecules striking the walls of the container
- Volume: depends on container size
- Temperature: a measure of the speed at which the particles move
- Gas properties are related to/affect one another



← Make sure your students are on track

Student copies with blanks  
Videos embedded right into  
your slideshow

## Gas Properties

- Pressure: \_\_\_\_\_
- Volume: \_\_\_\_\_
- Temperature: \_\_\_\_\_
- Gas properties are related to/affect one another



## Boyle's Law

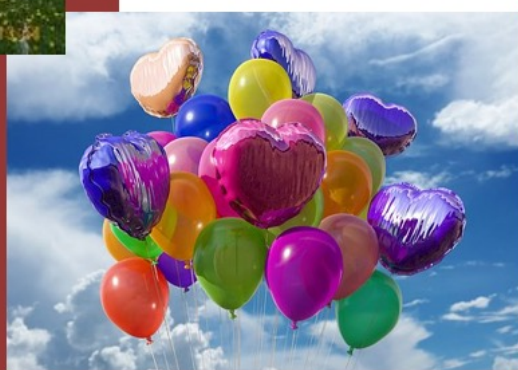
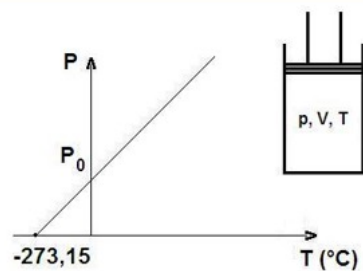
1662



- Pressure and volume inversely proportional (at constant temperature and mass)
- If pressure increases, volume decreases, and vice versa

# Interactive and Engaging Activities

## Pressure, Volume, and Temperature



7 Lab Station Activities to get your kids out of their seats and engaged in their learning

## Hot-Air Balloons

### Scientific Reading Comprehension Article and Extension Activity

#### Hot-Air Balloons



#### Pressure, Volume, and Temperature

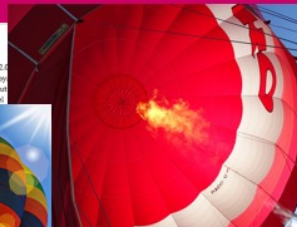
The pressure, volume, and temperature of gases are inextricably linked. One of the ways in which they are linked is through Charles's Law, named for French physicist and balloonist Jacques-Alexandre-César Charles. Charles's Law states that as long as pressure remains constant, the volume and temperature (in kelvins) of a set amount of gas are directly proportional to one another. This means that the hotter a gas gets, the more volume it can take up. This happens because heated gas molecules move around faster and use up more space. By spreading out in such a way, the amount of gas becomes less dense and can rise. This is what is meant by the term "heat rise". More specifically, "hot air rise". This property, in combination with Archimedes' Principle and Boyle's law, is responsible for the flight of hot-air balloons. Archimedes' principle states that the upward force of a fluid (a gas or liquid) on an object in that fluid is equal to the weight of the fluid displaced by the object.

This principle, also known as buoyancy, holds for the gas that surrounds us air. Boyle's Law states that, as long as temperature remains constant, the pressure and volume of a set amount of gas are inversely proportional to one another. Thus, if pressure increases, volume decreases, and vice versa.



#### Early Hot-Air Balloons

While Archimedes worked out his principle over 2,000 years ago, and he and others considered the possibility of buoyancy, it wasn't until the late 1700s that the principle was put into practice. On June 4, 1783, French brothers Joseph-Michel and Jacques-Etienne Montgolfier launched the first hot-air balloon.



From its origin, all passengers on board, Jean-François Pilâtre de Rozier and the Montgolfiers, were able to pilot their own hydrogen-filled balloon for two hours.

Hot air balloons are generally made of a lightweight material, such as silk or nylon.



Improve your students' **Literacy** and **Analysis Skills**, use as an **Emergency Substitute Plan**, or create **Applicability** in your classroom

# Get away from tired practices and unengaged students



# Provide a Scientifically-Proven means of instruction



# Incorporate Technology and Increase Collaboration

