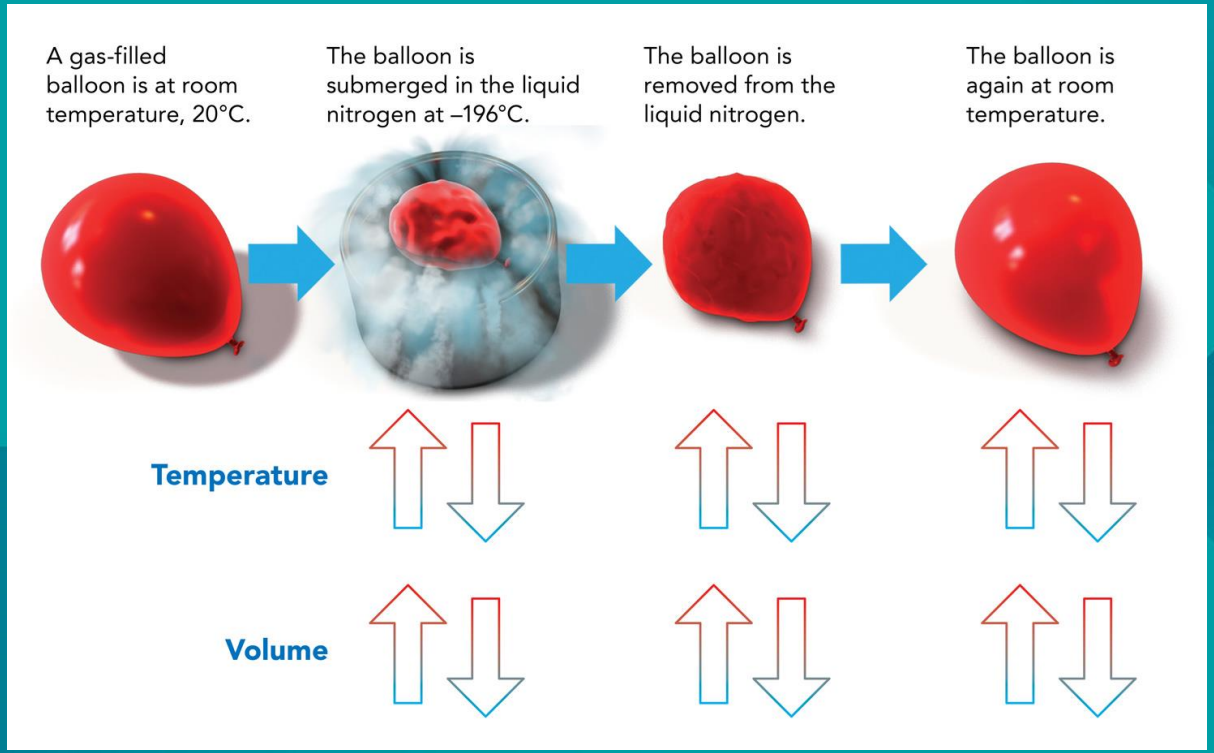
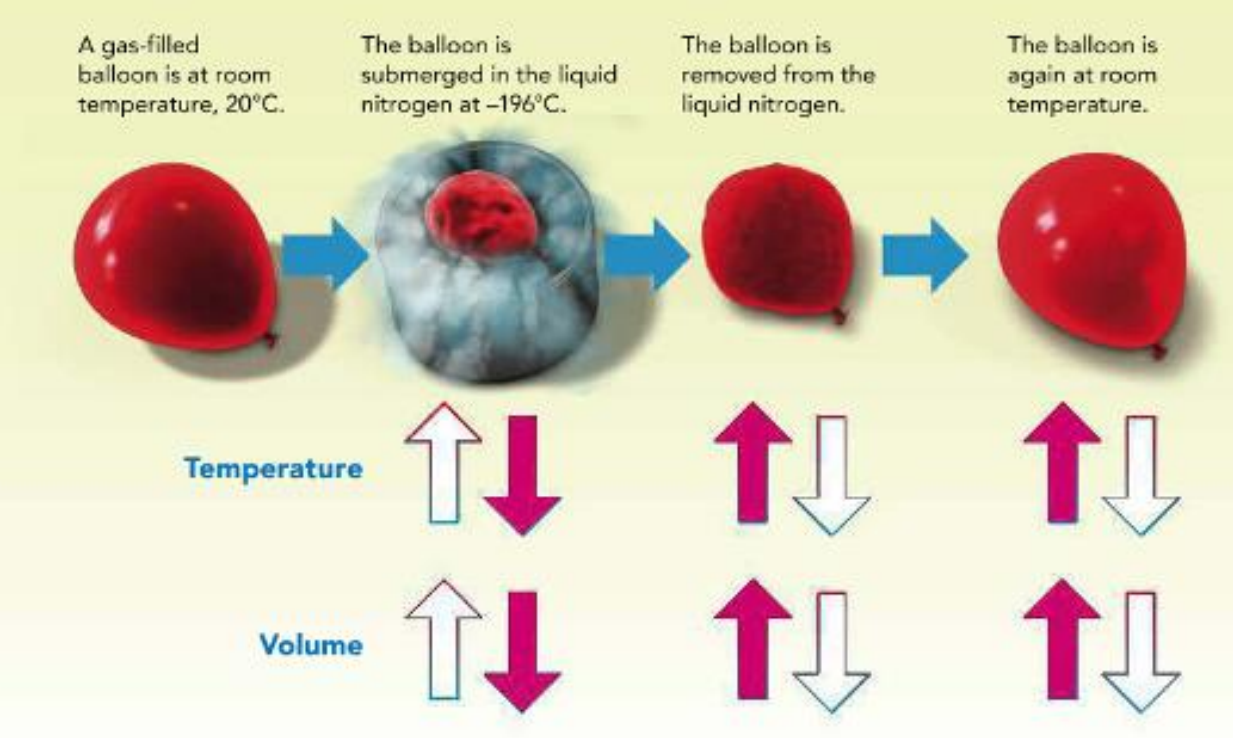
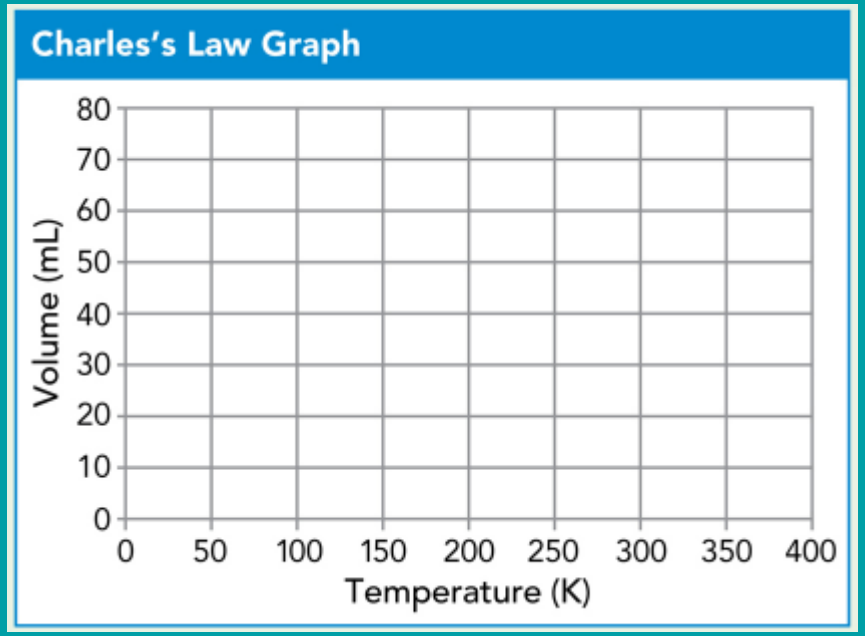
Gas Laws!

Charles's Law



Charles's Law



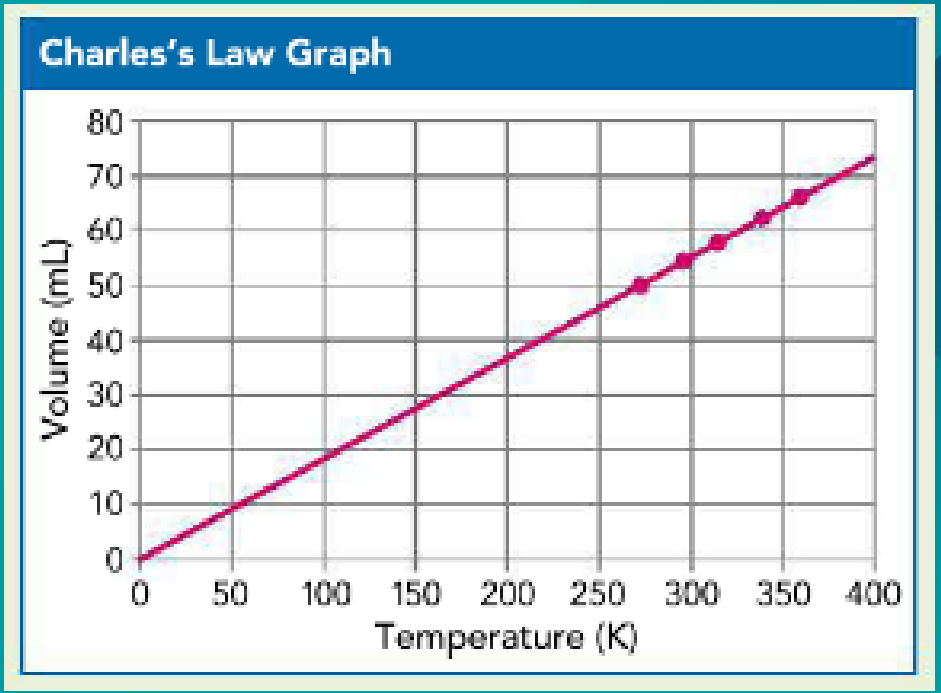


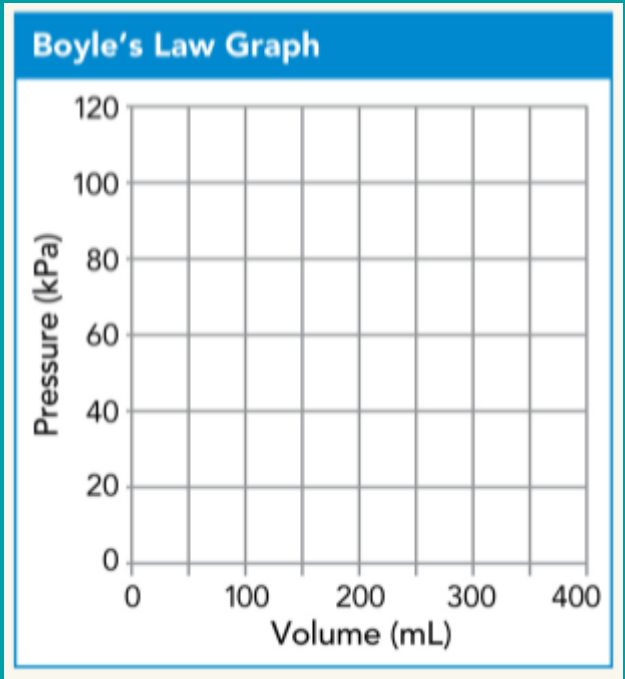
Temperature		Volume
(°C)	(K)	(mL)
0	273	50
20	293	54
40	313	58
60	333	62
80	353	66

The Completed Graph

What do you notice?

It's proportional!



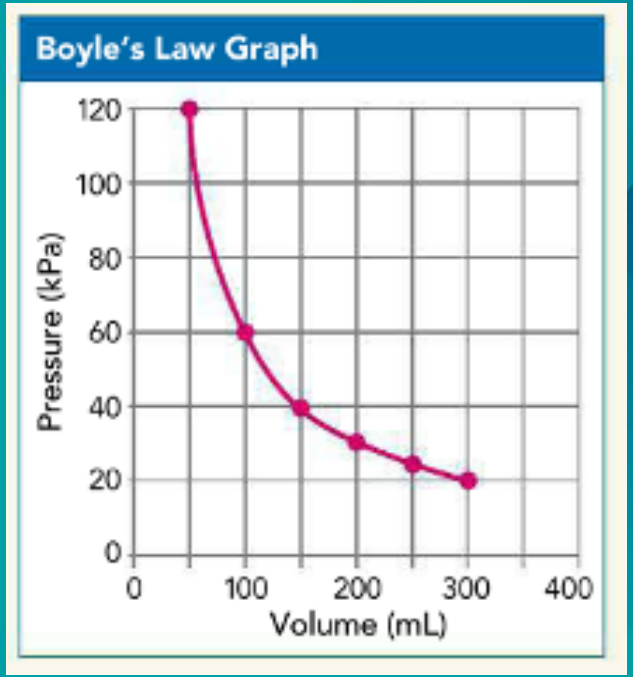


Volume (mL)	Pressure (kPa)
300	20
250	24
200	30
150	40
100	60
50	120

The Completed Graph

What do you notice?

It's inversely proportional!

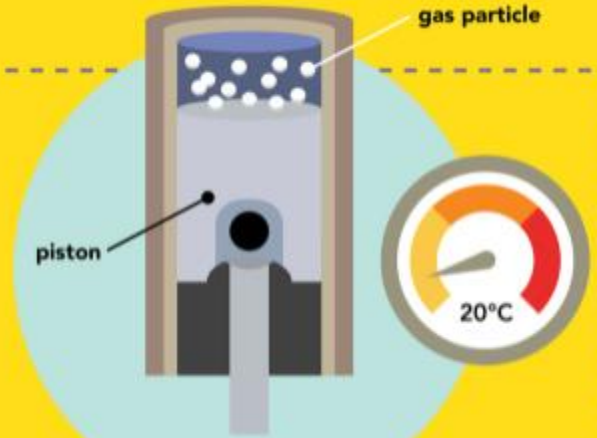


Temperature and Pressure

The image shows gas particles above a piston in a rigid container. The piston is held fixed.

Relate Change Finish this sentence by circling the correct answer: If the temperature of the gas increases, the pressure on the piston will

(increase / decrease).



Temperature and Volume

Now, the piston is free to move up or down. Heat is applied to the gas in the cylinder.

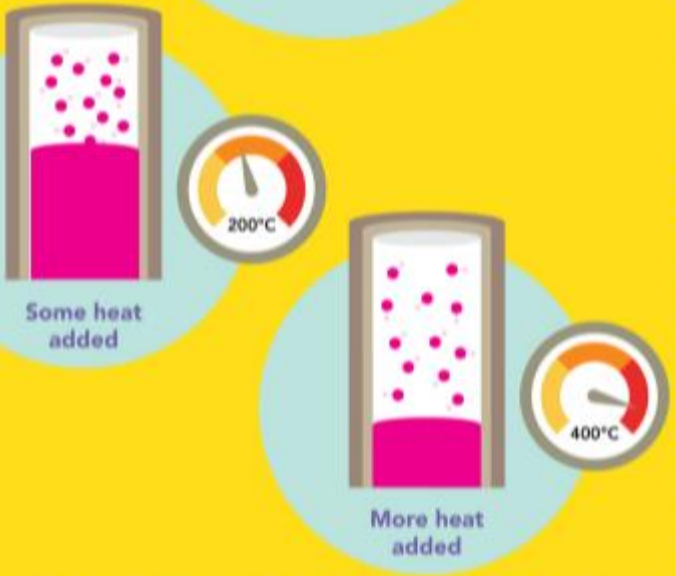
Apply Scientific Reasoning

Finish this sentence by circling the correct answer: As temperature increases, the volume of the gas will

(increase / decrease).

SEP Develop Models

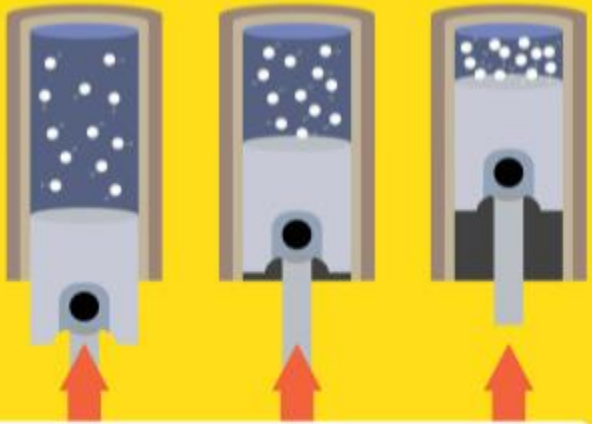
In each cylinder, draw the piston and the gas particles based on the temperature shown.



Pressure and Volume

This time, the gas is kept at a fixed temperature. The piston is pushed by an outside force, so the pressure on the gas increases.

Integrate with Visuals What happens to the volume of the gas as the pressure increases?



SEP Develop Models Under the cylinders, rank the pressure from lowest to highest with 1 being lowest and 3 being highest. Rank the volume

Pressure	.....	.....	.....
Volume	.....	.....	.....

1 2 3

1 2 3

Activity

Blow up one of the balloons in your lab supply bag and put it in the freezer until tomorrow's class.


The Physics of
HOT AIR BALLOONS

Hot air balloon science

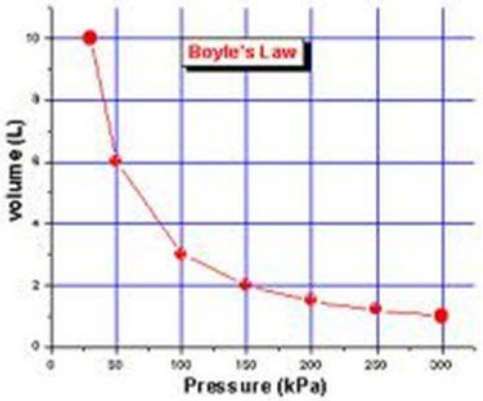
Check out these articles to learn how hot air balloons work:

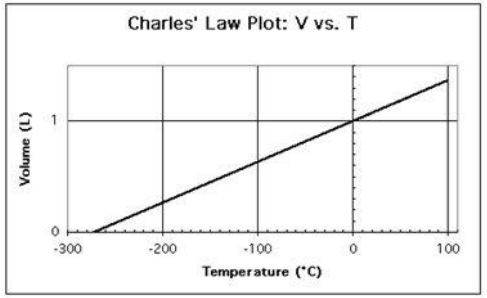
- https://science.howstuffworks.com/transport/flight/modern/hot-air-balloon.htm
- https://sciencemadefun.net/blog/november-2013-e-news-celebrate-soaring-science-of-the-hot-air-balloon/
- https://www.explainthatstuff.com/how-hot-air-balloons-work.html

Then, if you want (and have parent permission!!), create your own version of a hot air balloon:
https://www.homesciencetools.com/article/how-to-make-a-hot-air-balloon-science-project/

How would you explain how a hot air balloon works?

How can you use the two graphs to explain the two gas laws?





Boyle's Law and Charles' Law

Gas Laws for Physical Science

Charles's Law

Charles's law states that the volume of a gas is directly proportional to its absolute temperature, assuming the quantity of gas and pressure remain constant.

$$V_1 / T_1 = V_2 / T_2$$

sciencenote

Boyle's Law

The pressure of a gas increases as its volume decreases, assuming constant mass and temperature.

$$P \propto 1/V$$

$$P_1V_1 = P_2V_2$$

Pulling up increases volume and decreases pressure.

Pushing down decreases volume and increases pressure.

sciencenotes.org

Explore both laws here!

Simulation Review

What did you notice about the simulation?

How can you use the simulation to show both Charles's Law and Boyle's Law?

How could use combine both laws into one equation?

Compare the Laws

What changes and what stays constant?

What type of relationship is shown in the graph?

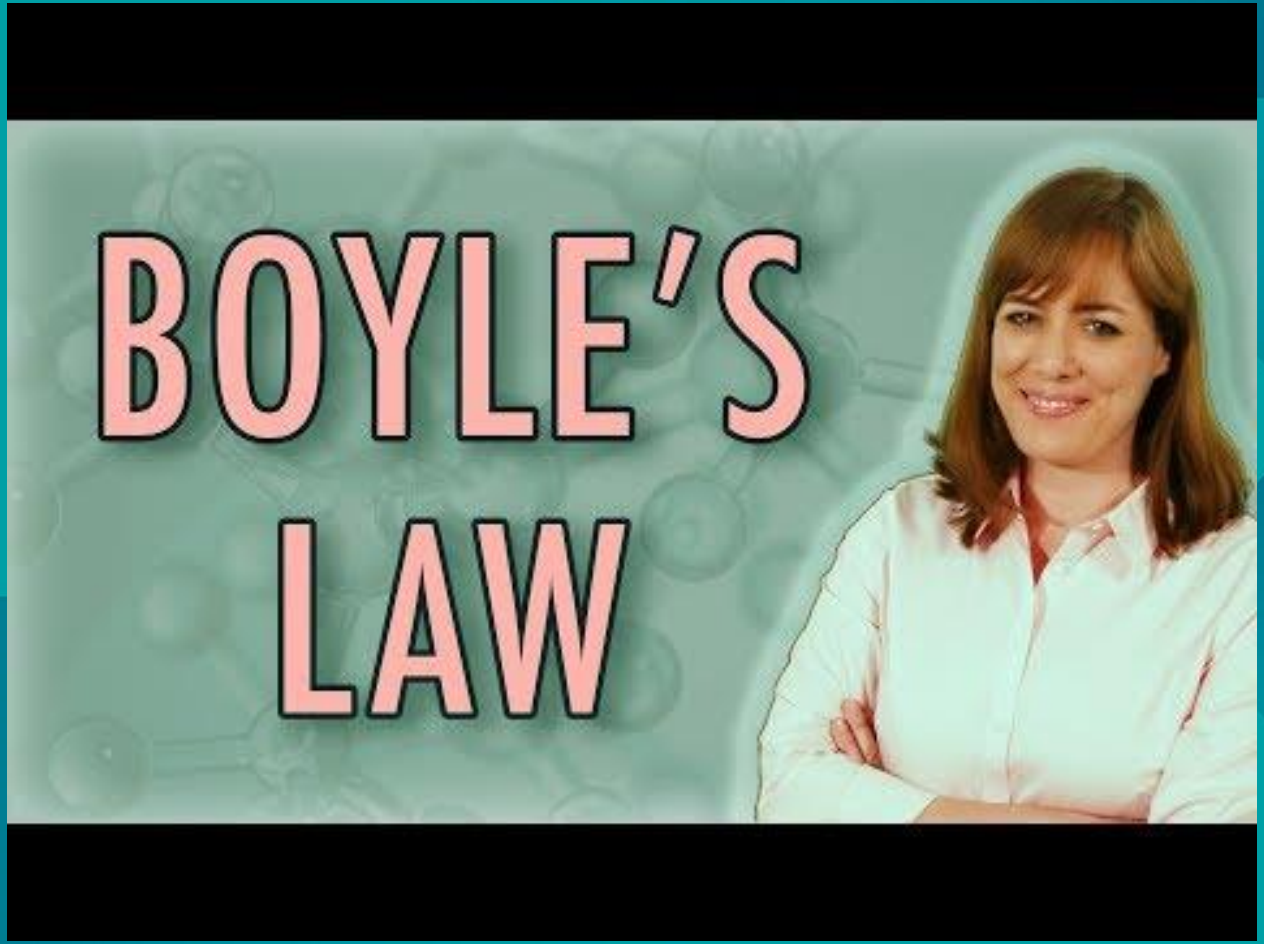
Boyle's Law

Charles's Law

What changes and what stays constant?

What type of relationship is shown in the graph?


CHARLES'S
LAW


BOYLE'S
LAW

An Ocean of Air
Gabrielle Walker

"Though Boyle was fluent in Latin, as in many other languages, he was unusual for philosophers of the time in that he chose to write in everyday, accessible English. Still more unusually, he eschewed the "normal" way of writing up science - philosophical discourses among fictitious persons - in favor of a straightforward descriptions of his apparatus, what he did for each experiment, and the results he obtained. He wanted people to understand exactly what he had done, and even to be able to repeat it. In this sense, he was one of the world's first true scientists."

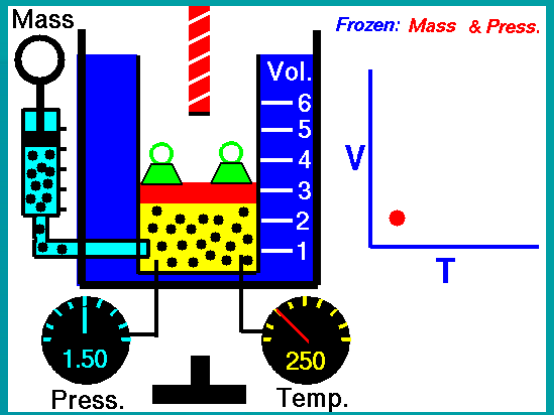
Ideal Gas Law
PV=nRT


Sec 12-0 THE IDEAL GAS LAW

Describe the two gas laws.

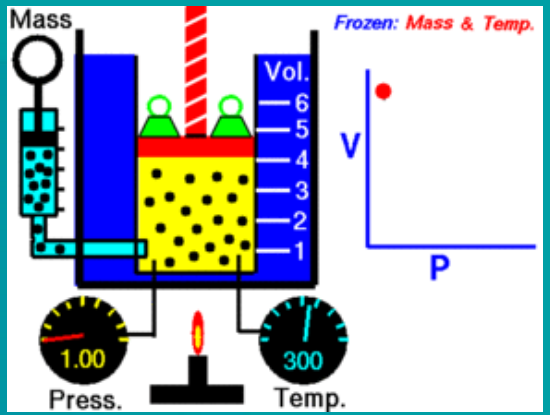
Charles's Law

When the pressure on a sample of gas is held constant, the temperature and the volume will be in direct proportion. (source)



Boyle's Law

The pressure on a gas is inversely proportional to the volume it occupies if the temperature remains constant. (source)



Problem Solving With Gas Laws

Your job is to solve the problems using your knowledge of the gas laws. You can use your notes and textbook to help you if you wish.

1. Read through the problem
2. Figure out what you know and what you need to know
3. Decide on which of the two gas laws to use
4. Solve the problem using the gas laws
5. Repeat until done with the whole Slide deck

When you are done, turn in your assignment and then look up real life examples of the two gas laws in action.

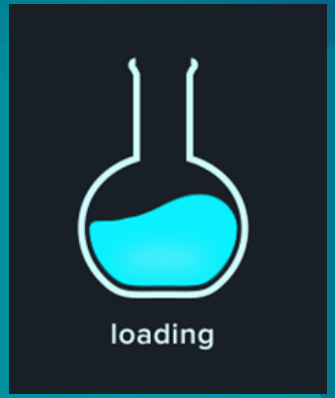
Group Assignment

Problem solve using gas laws

Group Jobs

- **Questioner**
  (asks questions of the group to keep it on track)
- **Note-taker**
  (shares their screen and does the problems on Slides)
- **Reporter**
  (share the answers with the class afterwards)
- **Timekeeper**
  (makes sure the group is using time wisely)
- **Checker (all group members)**
  (uses resources to make sure answers are correct)

Please wait while Miss Johnson sets up the groups…



What are your answers?