N-31
Basic Gas Law Equations

Target:

I can use basic gas law equations so solve for missing variables related to the conditions a gas is under.

But First…

A couple odds and ends

Use Kelvins!

Just another unit of measurement.

$$K = °C + 273$$

We will use Kelvin for all gas law problems

Why Use Kelvins?

Zero means a true zero with Kelvin scale. There are no negative temperatures.

We don’t want to end up with negative temperatures and then end up with negative volumes and pressures… wouldn’t make sense!

“Absolute Zero”

At 0 K there is NO MOLECULAR MOVEMENT!

Zero really means zero!

Units of Pressure

Lots of choices, just convert

Conversions	
1 atm =	1.01325×10^5 Pa
	101.325 kPa
	760 mmHg
	760 torr
	14.7 psi

STP

“Standard” Temperature & Pressure

0° C → 273 K

1 atm → 760 mmHg

Basic Gas Law Equations

Memorize them!

Boyle's Law

$$P_1V_1 = P_2V_2$$

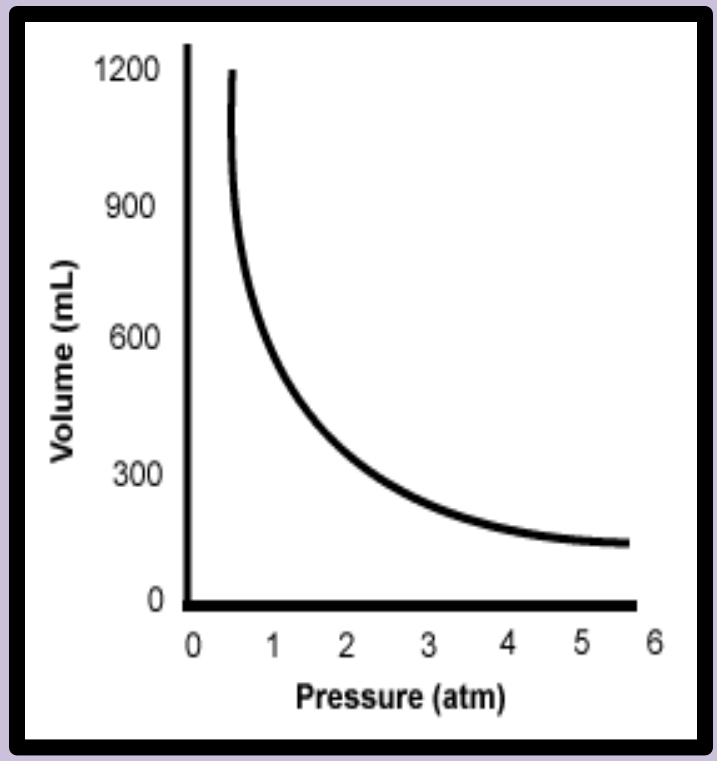
Boyle's Law

$$P_1V_1 = P_2V_2$$

- **Temperature and # moles held constant**
- **Indirect (or inverse) relationship**

  If pressure goes ↑

  Then volume goes ↓



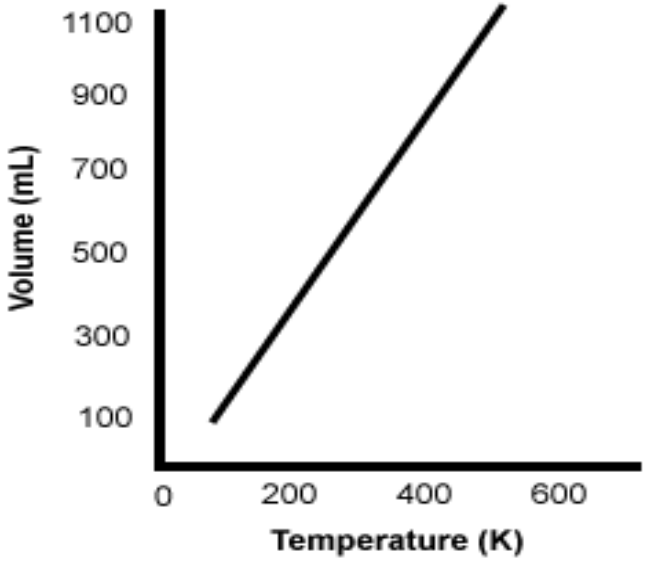
Charles' Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

Charles' Law

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

- **Pressure and # moles held constant**
- **Direct relationship**
  - ***If temperature goes ↑***
  - ***Then volume goes ↑***



**note* Graph doesn't go all the way to zero because the molecules will eventually get as close as possible and they will still always take up space*

Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

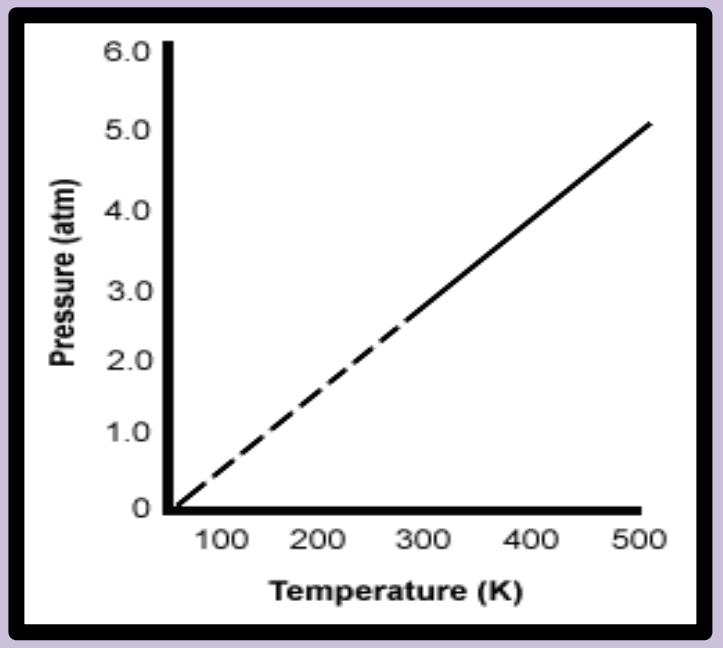
Gay-Lussac's Law

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

- **Volume and # moles held constant**
- **Direct relationship**

  If temperature goes ↑

  Then pressure goes ↑



**note* Graph doesn't go all the way to zero because at low temperatures and pressures it won't be a gas anymore, it will turn into a solid or a liquid. We use a dotted line to show the portions that are not gas phase*

Avogadro's Law

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

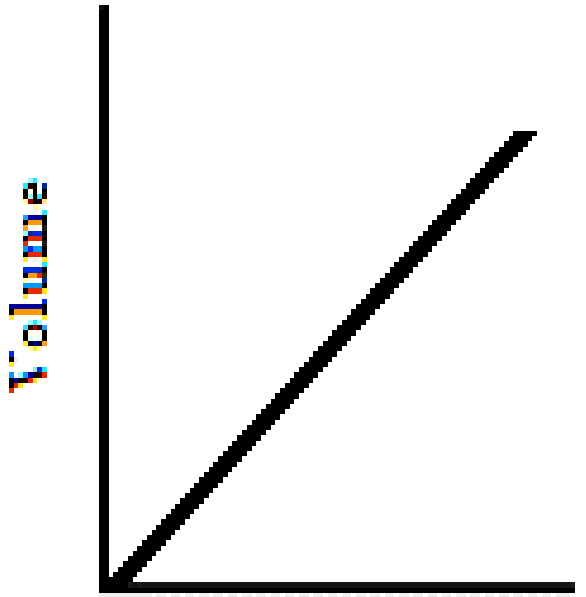
Avogadro's Law

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

- **Pressure and temperature held constant**
- **Direct relationship**

  If # of moles goes ↑

  Then volume goes ↑



Combined Gas Law

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Combined Gas

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

- **# of moles held constant**
- **Combines most common variables together – not common to change moles of gas**