

Gas Laws Investigation

Chemistry / Physical Science · Grades 9–12

Use controlled virtual experiments to discover how pressure, volume, temperature, and amount of gas are related. The model calculates values from $PV = nRT$.

NGSS connection: HS-PS3-2 (particle-motion models of energy) plus analyzing and interpreting data. Gas laws are not a stand-alone HS NGSS performance expectation.

Name: _____ Class: _____ Date: _____

Before You Begin

1. A gas is compressed to a smaller volume while temperature and amount stay constant. Predict what happens to pressure and explain using particle collisions.

Part A · Boyle's Law: Pressure vs. Volume

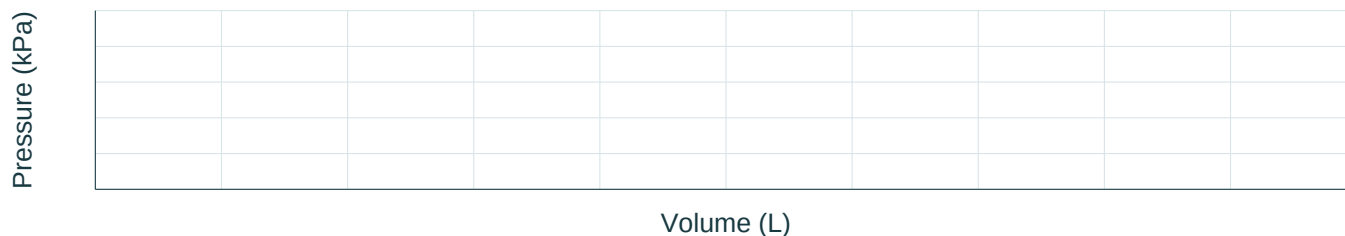
Select Boyle's Law. Temperature is fixed at 300 K and amount is fixed at 1.00 mol. Collect at least five trials spread across the volume range.

Trial	Volume (L)	Pressure (kPa)	$P \times V$
1			
2			
3			
4			
5			

2. Describe the relationship between volume and pressure. Is it direct or inverse?

3. Compare your $P \times V$ values. Why should they be approximately constant in this mode?

Sketch or copy the pattern from the model graph



Part B · Charles's Law: Volume vs. Temperature

Select Charles's Law. Pressure is fixed at 101.325 kPa and amount is fixed at 1.00 mol. Collect at least five trials.

Trial	Temperature (K)	Volume (L)	V / T
1			
2			
3			
4			
5			

4. Describe the volume-temperature relationship. Why is Kelvin temperature required for a proportional gas-law relationship?

Part C · Choose a Third Relationship

Choose either Gay-Lussac's Law (P vs. T) or Avogadro's Law (V vs. n). Keep the model's controlled variables fixed and collect four trials.

Law selected	Independent variable	Dependent variable	Variables held constant

Trial	Independent value	Dependent value
1		
2		
3		
4		

5. State the relationship you discovered and support it with two data points.

Part D • Ideal Gas Equation Station

Use the model's calculation station. Use $R = 8.314 \text{ kPa}\cdot\text{L}/(\text{mol}\cdot\text{K})$. Show your setup before checking with the model.

Problem	Given	Solve for	Work / model result
1	V = 15.0 L n = 1.25 mol T = 350 K	P	
2	P = 101.325 kPa n = 0.75 mol T = 425 K	V	
3	P = 180 kPa V = 12.0 L T = 320 K	n	
4	P = 95.0 kPa V = 18.0 L n = 0.80 mol	T	

Synthesis

6. Complete the sentence with evidence: Pressure responds directly to _____ and _____, and inversely to _____ when the other variables are controlled.

7. How does the animated particle view help explain one of the relationships you measured?

8. Real gases can deviate from ideal behavior at high pressure and low temperature. Why should the simulation be described as an ideal-gas model rather than a perfect copy of reality?
