Cycle 7 Chemistry 2 Lesson 3

“Gases” Unit

Charles’s Law – Relationship between Temperature & Volume

Lab day is TOMORROW

Bring Clean, Empty, Aluminum Soda Cans!

Demo: Will the water level rise or fall? Why?

Vocab: **“Charles’s Law” $V_1/T_1 = V_2/T_2$**

“Kelvin Temperature” °K = °C + 273.15

Classwork:

Charles’ Law Worksheet

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Measurable Properties of Gases, *continued*

Temperature-Volume Relationships

- Heating a gas makes it expand.
- Cooling a gas makes it contract.
- In 1787, the French physicist Jacques Charles discovered that a gas's volume is directly proportional to the temperature on the Kelvin scale if the pressure remains the same.
- **Kelvin Temperature: °K = °C + 273.15**

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Measurable Properties of Gases, *continued*

Charles's Law

- The direct relationship between temperature and volume is known as **Charles's law.**

- $V_1/T_1 = V_2/T_2$

- Charles's law states that for a fixed amount of gas at a constant pressure, the volume of the gas increases as the temperature of the gas increases and the volume of the gas decreases as the temperature of the gas decreases.

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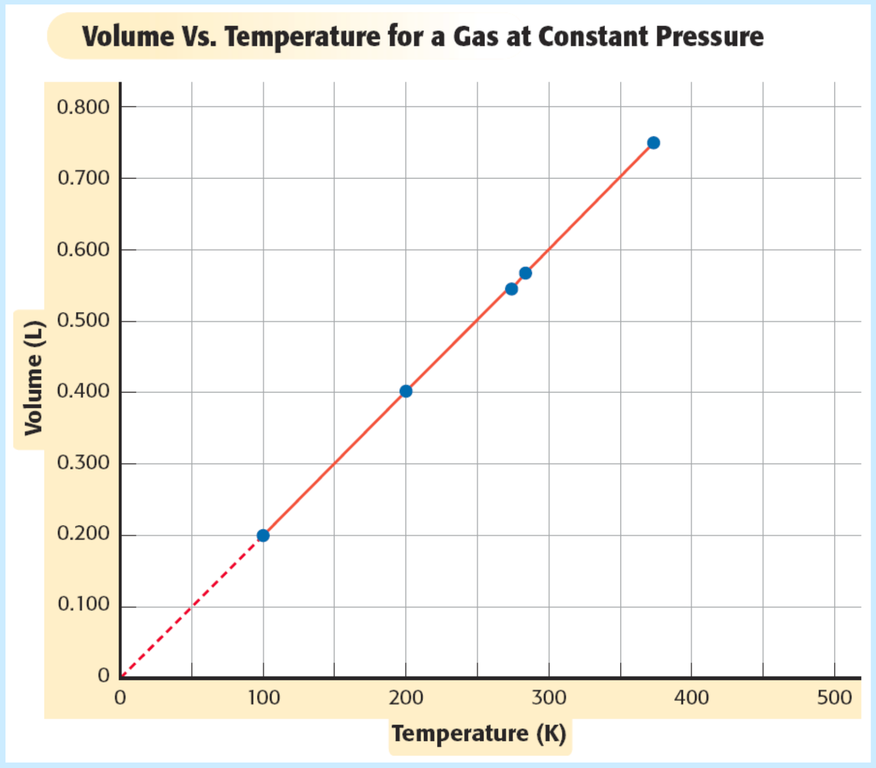
Measurable Properties of Gases, *continued*

Charles' Law, *continued*



- When the temperature scale is in kelvins, the graph shows a direct proportion between volume of a sample of gas and the temperature.

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Measurable Properties of Gases, *continued*

Charles's Law, *continued*

- At constant pressure, the volume of a sample of gas divided by its absolute temperature is a constant, *k.*
- Charles's law can be stated as the following equation.

$$\frac{V}{T} = k$$

- If all other conditions are kept constant, V/T will remain the same.

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

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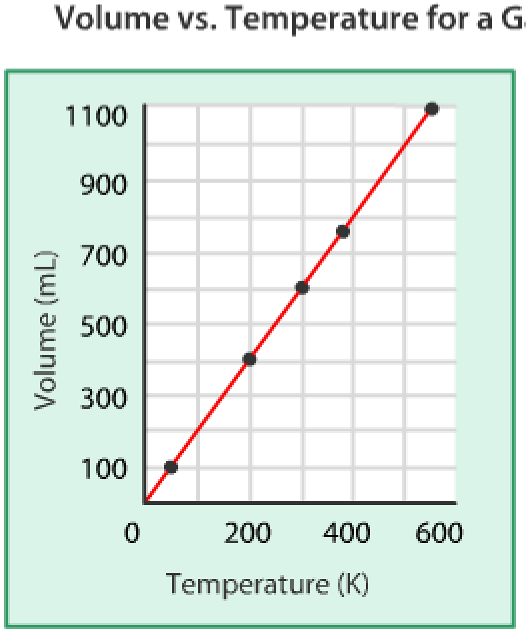
Equation for Charles's Law



$$\frac{V}{T} = k$$

$$\frac{\text{volume}}{\text{absolute temperature}} = \text{constant}$$

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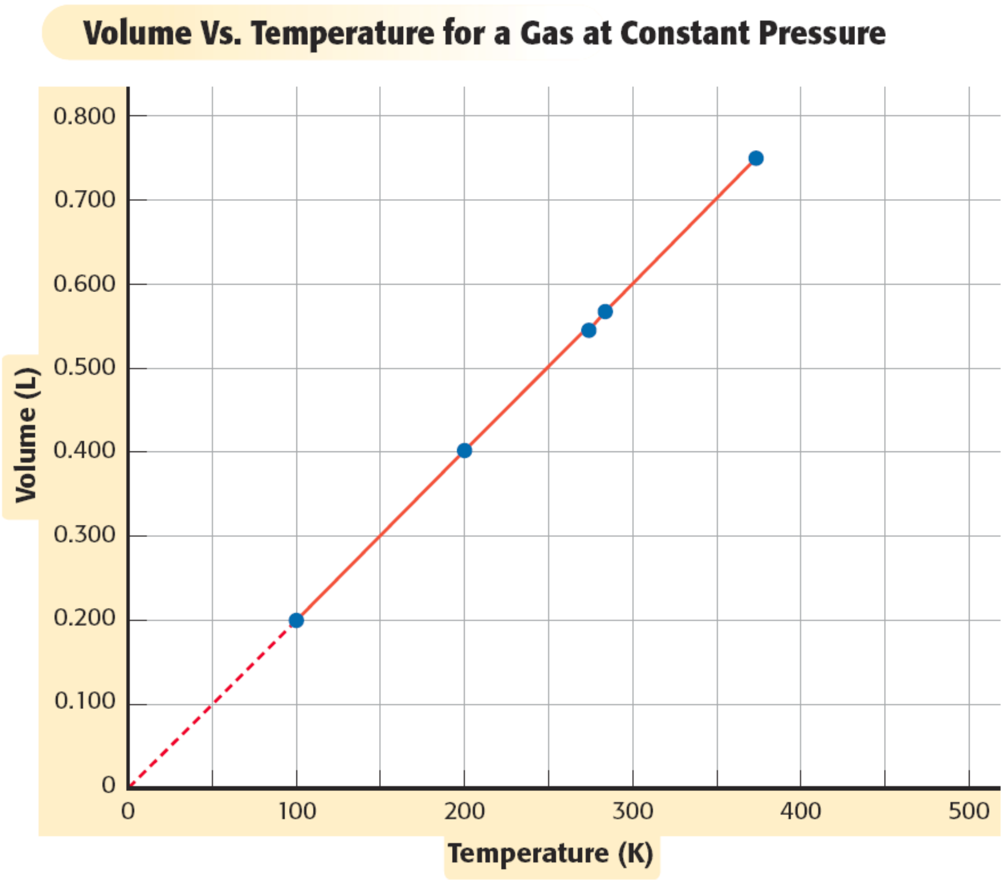
Volume Versus Temperature for a Gas at Constant Pressure



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Solving Volume-Temperature Problems

Sample Problem C

A balloon is inflated to 665 mL volume at 27°C. It is immersed in a dry-ice bath at −78.5°C. What is its volume, assuming the pressure remains constant?

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Chapter menu

Resources

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Solving Volume-Temperature Problems, *continued*

Sample Problem C Solution

$V_1 = 665$ mL $T_1 = 27°C$

$V_2 = ?$ $T_2 = -78.5°C$

$T_1 = 27°C + 273 = 300$ K $T_2 = -78.5°C + 273 = 194.5$ K

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{665 \text{ mL}}{300 \text{ K}} = \frac{V_2}{194.5 \text{ K}}$$

$$V_2 = \frac{(665 \text{ mL})(194.5 \text{ K})}{300 \text{ K}} = 431 \text{ mL}$$

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