Cycle 7 Chemistry II Lesson 5

“Gases” Unit
The Ideal Gas Law

Onlevel: Ideal Gas Law and the Mole Concept

Honors: Deflategate Case Study

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"Gases" Unit
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Warmup:

What is the volume of 10 grams of helium (He) at 25 C and 1 atm?

Classwork:

A Very Bad Ideal Gas Law Worksheet
Ideal Gas Law Worksheet #2

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Cycle 7 Honors Chemistry II Lesson 5

"Gases" Unit
The Ideal Gas Law

Vocab: "Gay-Lussac Law", "Gauge Pressure"

Classwork:

Example: Tire problem
Deflategate Case Study
Questions 1, 3, 5-7, 9

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The Ideal Gas Law, *continued*

Gay-Lussac's law	$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

Gay-Lussac's Law states that a gas in a container with constant volume has pressure directly proportional to its absolute temperature.

Deriving the Gay-Lussac Law

- $P_1V_1 = nRT_1$
- $P_2V_2 = nRT_2$

- Constant volume means that $V_1 = V_2$ giving
- $P_1V = nRT_1$
- $P_2V = nRT_2$
- Divide one equation by the other to obtain
- $P_1/P_2 = T_1/T_2$
- Cross-multiply to get $P_1T_2 = T_1P_2$
- Divide by T_1T_2 to get $P_1/T_1 = P_2/T_2$

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Gauge Pressure vs. True Pressure

- The **gauge pressure** of a gas in a container is its pressure minus the pressure of the atmosphere.
- This is the value read on a pressure gauge.
- In gas law problems, the **true pressure** should generally be used, especially in low-pressure situations where atmospheric pressure makes a large difference.

Example Problem

- A tire is inflated to a gauge reading of 30 psi at 25 C.
- The tire is then cooled to 10C. What is the new gauge pressure?
- Assume atmospheric pressure is 14.7 psi in both cases.

- $P_1 = 30 + 14.7 = 44.7$ psi. $T_1 = 298$ K. $T_2 = 283$ K. $P_2 = P_1T_2/P_1$
- $P_2 = 42.5$ psi
- New gauge pressure is 42.5 – 14.7 = 27.8 psi

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