Gas Laws: Real Gases

Real Gases

- Real gases deviate from ideal gas law
- Quantify deviations using compressibility factor, Z.

 Need corrections to account for nonideal behavior.

van der Waals

 van der Waals adds two corrections to account for non-ideal behavior

attractive correction

- volume correction
- Insert corrections into ideal gas law

van der Waals

Compressibility of van der Waals

van der Waals constants are unique to each gas.

	a (L ² bar ² /mol ²)	b (L/mol)	
He	0.034	0.024	
N_2	1.35	0.039	
CH_4	2.27	0.043	
	CEM 484		

Intermolecular forces

Two main forces contribute to non-ideal behavior in neutral molecules.

- Iclicker: What is the correct ordering for the three gases CH₄, N₂, and He?
 - $\circ \quad A a_{N2} > a_{CH4} > a_{He}$
 - $\circ \quad A a_{He} > a_{N2} > a_{CH4}$

Gas Density

 Performance of gas laws can be monitored using P vs. gas density curves

Other gas laws

Two other gas equations

Critical Behavior

Critical behavior explored on a P-V diagram.

• Critical point on $P-\overline{V}$ isotherms

Critical point defined by inflection point.

Iclicker

Assume someone told you that the following was an equation of state for a certain gas.

$$P = \frac{RT}{\overline{V}} - \frac{B}{\overline{V}^2} + \frac{C}{\overline{V}^3}$$

Using the definition of a critical point what is the critical molar volume in terms of the constants B and C?