

# Noteset 7B (Part 3) - In Class Noteset

## Combined Gas Law

### Fundamental Gas Laws (P, V, and T)

#### Boyle's Law

P indirect rel. to V  
T is constant

$$P_1 V_1 = P_2 V_2$$

#### Charles' Law

V direct rel. to T  
P is constant

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

$$[V_1 T_2 = V_2 T_1]$$

#### Gay-Lussac's Law

P direct rel. to T  
V is constant

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

$$[P_1 T_2 = P_2 T_1]$$

### Fundamental Gas Laws

Picking correct equation

$$P_1 V_1 = P_2 V_2 \quad \checkmark$$

$$V_1 T_2 = V_2 T_1$$

$$P_1 T_2 = P_2 T_1$$

$$P_1 = 4.32 \text{ atm} \quad V_1 = 2.47 \text{ L}$$

$$P_2 = 6.13 \text{ atm} \quad V_2 = \underline{\hspace{2cm}} \text{ L}$$

(Pick eqn. w/ correct variables)

$$V_2 = \frac{P_1 V_1}{P_2} = \frac{4.32 \text{ atm} \cdot 2.47 \text{ L}}{6.13 \text{ atm}}$$

$$\underline{V_2 = 1.74 \text{ L}}$$

# Fundamental gas laws

## Combined gas law

Indirect Rel.    Direct Rel.  
P to V    V to T and P to T

Overall Relationship depends on the amount of P, V and T in problem:  
small T: Indirect overall  
large T: direct overall

## Combined gas law example

$$P_1 V_1 T_2 = P_2 V_2 T_1$$

$$V_1 = \text{---} L \quad V_2 = 2.63 L \quad ?$$

$$P_1 = 3.08 \text{ atm} \quad P_2 = 5.50 \text{ atm} \quad \uparrow$$

$$T_1 = 447.39 \text{ K} \quad T_2 = 347.11 \text{ K} \quad \downarrow$$

expect vol. will decrease!

$$\text{top} \div (3.08 \times 347.11) =$$

## Combined gas law equation

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

$$P_1 V_1 T_2 = P_2 V_2 T_1$$

No variables are constant.

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

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

$$V_1 = \frac{5.50 \text{ atm} \cdot 2.63 \text{ L} \cdot 447.39 \text{ K}}{3.08 \text{ atm} \cdot 347.11 \text{ K}}$$
$$V_1 = 6.05 \text{ L}$$