South Pasadena • Chemistry

Name _____
Period ___ Date ___/___/___

12 • The Gas Laws

THE COMBINED GAS LAW

In practical terms, it is often difficult to hold any of the variables constant. When there is a change in pressure, volume and temperature, the combined gas law is used.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \text{or} \quad P_1 \times V_1 \times T_2 = P_2 \times V_2 \times T_1$$

$$K = °C + 273$$

See "scratch paper" next page

Complete the following chart.

	P_1	V_1	T_1	P_2	V_2	T_2
1	1.50 atm	3.00 L	293 K ~~20.0 °C~~	2.50 atm		303K ~~30.0 °C~~
2	720. torr	256. mL	298K ~~25.0 °C~~		250. mL	323K ~~50.0 °C~~
3	600. mmHg	2.50 L	295 K ~~22.0 °C~~	760. mmHg	1.80 L	
4		750. mL	273 K ~~0.00 °C~~	2.00 atm	500. mL	298K ~~25.0 °C~~
5	95.0 kPa	4.00 L		101. kPa	6.00 L	471. K or 198. °C
6	650. torr		373K ~~100. °C~~	900. torr	225. mL	423 K ~~150. °C~~
7	850. mmHg	1.50 L	288K ~~15.0 °C~~		2.50 L	303 K ~~30.0 °C~~
8	125. kPa	125. mL		100. kPa	100 mL	348K ~~75.0 °C~~

COMBINED

1. $V_2 = \frac{P_1 V_1 T_2}{P_2 T_1} = \frac{(1.50\ \text{atm})(3.00\ \text{L})(303\ \text{K})}{(2.50\ \text{atm})(293\ \text{K})} = \boxed{1.86\ \text{L}}$

2. $P_2 = \frac{P_1 V_1 T_2}{V_2 T_1} = \frac{(720\ \text{torr})(256\ \text{mL})(323\ \text{K})}{(250.\ \text{mL})(298\ \text{K})} = \boxed{799\ \text{torr}}$

3. $T_2 = \frac{P_2 V_2 T_1}{P_1 V_1} = \frac{(760\ \text{mmHg})(1.80\ \text{L})(295\ \text{K})}{(600\ \text{mmHg})(2.50\ \text{L})} = \boxed{269\ \text{K}}$ $(=-4\ ^\circ\text{C})$

4. $P_1 = \frac{P_2 V_2 T_1}{V_1 T_2} = \frac{(2.00\ \text{atm})(500\ \text{mL})(273\ \text{K})}{(750\ \text{mL})(298\ \text{K})} = \boxed{1.22\ \text{atm}}$

5. $T_1 = \frac{P_1 V_1 T_2}{P_2 V_2} = \frac{(95.0\ \text{kPa})(4.00\ \text{L})(471\ \text{K})}{(101\ \text{kPa})(6.00\ \text{L})} = \boxed{295\ \text{K}}$ $(=22\ ^\circ\text{C})$

6. $V_1 = \frac{P_2 V_2 T_1}{P_1 T_2} = \frac{(900\ \text{torr})(225\ \text{mL})(373\ \text{K})}{(650\ \text{torr})(423\ \text{K})} = \boxed{275\ \text{mL}}$

7. $P_2 = \frac{P_1 V_1 T_2}{V_2 T_1} = \frac{(850\ \text{mmHg})(1.50\ \text{L})(303\ \text{K})}{(2.50\ \text{L})(288\ \text{K})} = \boxed{537\ \text{mmHg}}$

8. $T_1 = \frac{P_1 V_1 T_2}{P_2 V_2} = \frac{(125\ \text{kPa})(125\ \text{mL})(348\ \text{K})}{(100\ \text{kPa})(100\ \text{mL})} = \boxed{544\ \text{K}}$ $(=271\ ^\circ\text{C})$