1

Measurement: Pressure

Science units include atmospheres (atm), mm Hg, torr, and pascal (Pa).

1 torr = 1 mm Hg

760 torr = 1 atm

760 mm Hg = 1 atm

1 atm = 1.01 X 10^5 Pa

2

Measurement: Volume

- mL will be encountered, but L also used

3

Measurement: Temperature

Must be in Kelvins

$^oC + 273 = Kelvins$

4

Gas Laws: Boyle's Law

Boyle's Law- At constant temperature

$$V \alpha \frac{1}{P}$$

5

Gas Laws: Charles' Law

Charles' Law- At const. P

$V \alpha T$

6

Gas Laws: Gay-Lussac's Law

Gay-Lussac's Law- At const. V

$P \alpha T$

7

Combined Gas Law

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Where P= pressure,V=volume, and T=temp (K)

8

Practice Problems: Combined Gas Law

What volume will be occupied by a gas when cooled from 37°C to 4°C? The initial volume was 368 mL. Assume the pressure change is insignificant.

You have a 5.29 L cylinder of gas which is compressed to 345 mm Hg. You increase the pressure to 468 mm Hg. Assuming the temperature did not change as you applied the pressure, what volume does the gas now occupy?

9

Practice Problems: Combined Gas Law

What temperature is required to cause the pressure of a (steel) cylinder of gas to increase from 350 to 500 mm Hg? The initial temperature was 298 K.

10

Practice Problems: Combined Gas Law

Suppose you have 856 mL of a gas. A weather front comes through, and the barometric pressure changes from 780 mm Hg to 720 mm Hg. Along with this, the temperature changes from 86°F (30.°C) to 72°F (22°C). What is the new volume of your gas?

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Dalton's Law of Partial Pressures

The total pressure of a gas mixture equals the sum of the partial pressures of each gas in the mixture.

$$Pt = P1 + P2 + ... + Pn$$

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Practice Problems: Dalton's Law of Partial Pressures

What is the total pressure of a mixture of He and N_2 if their partial pressures are 240 and 850 mm Hg?

A gas mixture with 80% He and 20% O_2 has a total pressure of 800 mm Hg. What is the partial pressure of O_2?

If the barometric pressure changes from 780 mm Hg to 720 mm Hg, how much does the pressure of N_2, which is 78% of the atmosphere, change?

13

Avagadro's Law

Avagadro's Law- Equal volumes of different gases at the same temperature and pressure have equal numbers of molecules.

At *STP*, one mol occupies 22.4 L. From this, can calculate *universal gas constant*, R.

STP is 1.00 atm, 273 K

R = 0.0821 L·atm/mol·K

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The Ideal Gas Law

$$PV = nRT$$

where P = pressure, V = volume, n = number of moles, R = universal gas constant, T = temperature

15

Practice Problems - Ideal Gas Law

1. What volume will 52.5 g of CH_4 occupy at STP?
2. You heat 1.437 g NH_3 in a stoppered 250 mL flask until it explodes (425^{o}C). What was the pressure inside the flask immediately prior to the explosion?