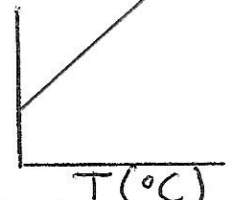
Sketch the graph — variation? partial — in English: $P\uparrow = \uparrow T(°C)$ ✓ — direct $\uparrow P = \uparrow T(K)$



1) $\uparrow T = \uparrow$ ave E_K of parts. Why?

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

2) $\uparrow E_K = \uparrow$ coll w sides

Gay-Lussac's Law Worksheet

Assume that the volume and the amount of gas are constant in the following problems.

1. A gas in a sealed container has a pressure of 125 kPa at a temperature of 30.0°C. If the pressure in the container is increased to 201 kPa, what is the new temperature?

P_1; $T_1 + 273 = 303.0$ K; P_2; $T_2 = ?$

$$T_1 \times T_2 \times \frac{P_1}{T_1} = \frac{P_2}{T_2} \times T_2 \times \frac{T_1}{P_1} = \frac{(201 \text{ kPa})(303 \text{ K})}{(125 \text{ kPa})} = 487 \text{ K}$$

2. The pressure in an automobile tire is 1.88 atm at 25.0°C. What will be the pressure if the temperature warms up to 37.0°C?

P_1; $T_1 + 273 = 298.0$ K; $T_2 + 273 = 310.0$ K; P_2?

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

$$\frac{(310.0 \text{ K})(1.88 \text{ atm})}{(298.0 \text{ K})} = P_2 = 1.96 \text{ atm}$$

3. Helium gas in a 2.00 L cylinder is under 1.12 atm pressure. At 36.5°C that same gas sample has a pressure of 2.56 atm. What was the initial temperature of the gas in the cylinder?

V_1; P_1; $T_2 + 273 = 309.5$ K; P_2; T_1?

same ✓

$$T_2 \times \frac{T_1}{P_2} \times \frac{P_1}{T_1} = \frac{P_2}{T_2} \times \frac{T_1}{P_2} \times T_2 = \frac{(309.5 \text{ K})(1.12 \text{ atm})}{2.56 \text{ atm}}$$

$T_1 = 135$ K

$-P_1$ $\quad -T_1+273$

4. If a gas sample has a pressure of 30.7 kPa at 0.00°C, by how much does the temperature have to decrease to lower the pressure to 28.4 kPa? $\quad P_2$

not ANS!

$$T_1 \times \frac{T_2 \times P_1}{P_1\, T_1} = \frac{P_2 \times T_2 \times T_1}{T_2\, P_1} = \frac{28.4\,kPa \times 273.0\,K}{30.7\,kPa} = 253\,K \quad (-2!)$$

no change in volume

Ans = 273.0 K − 253K = 20. K ↓ of T

ANS!

$-P_1$

5. A rigid plastic container holds 1.00 L methane gas at 0.9 atm pressure when the temperature is 22.0°C. How much more pressure will the gas exert if the temperature is raised to 44.6°C?

$T_1 + 273 = 295.0\,°C$

$T_2 + 273 = 317.6\,K$

1sb!

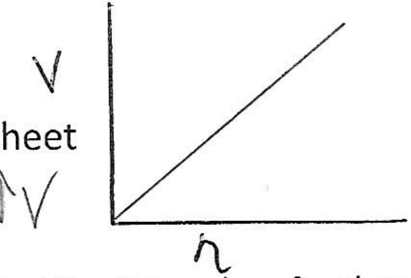
$$T_2 \times \frac{P_1}{T_1} = \frac{P_2 \times T_2}{T_2} = \frac{(317.6\,K)(0.9\,atm)}{(295.0\,°C)}$$

$P_2 = 1$ atm NOT ANS! −2

1 atm
− 0.9 atm
0.1 atm answer

more P

$\frac{V_1}{n_1} = \frac{V_2}{n_2}$ Sketch the graph:



Avogadro's Law Worksheet

variation? direct — in English $\uparrow n = \uparrow V$

Why? if you increase the # of parts then the vol will expand (balloon, syringe etc)

1. A 25.5 liter balloon holding 3.5 moles of carbon dioxide leaks. If we are able to determine that 1.9 moles of carbon dioxide escaped before the container could be sealed, what is the new volume of the container?

3.5 mol had − 1.9 mol lost = 1.6 mol left

$n_2 \times \frac{V_1}{n_1} = \frac{V_2}{n_2} \times n_2 = \frac{(1.6\,mol)(25.5\,L)}{(3.5\,mol)}$

$V_2 = 12\,L$

2. If Sample #1 contains 2.98 moles of hydrogen at 35.1 degrees C and 2.3 atm in a 32.8 L container. How many moles of hydrogen are in a 45.3 liter container under the same conditions? of T & P

(V_1, n_1, $+273 = T_1$, P_1, V_2)

$n_1 \times \frac{n_2}{V_1} \times \frac{V_1}{n_1} = \frac{V_2 \times n_2 \times n_1}{n_2\, V_1} = \frac{(45.3\,L)(2.98\,mol)}{(32.8\,L)}$

$n_2 = 4.12$ moles

3. Sally adds 3.13 moles of argon to a 5.29 liter balloon that already contained 2.51 moles of argon. What is the volume of the balloon after the addition of the extra gas?

($+n_1 = n_2$, V_1, expands, n_1, V_2?)

3.13 mol + 2.51 mol = 5.64 mol

$n_2 \times \frac{V_1}{n_1} = \frac{V_2}{n_2} \times n_2 = \frac{(5.64\,mol)(5.29\,L)}{(3.31\,mol)}$

$V_2 = 9.01\,L$

more moles more volume

Avogadro's Law Worksheet Name:______________________________

4. If Sample #1 contains 2.3 moles of chlorine gas in a 3.5 liter balloon and at the same conditions Sample #2 contains 1.2 moles of chlorine gas, what is the volume of the balloon that contains sample #2?

n_1, V_1, n_2, V_2?

$$n_2 \times \frac{V_1}{n_1} = \frac{V_2}{n_2} \times n_2 = \frac{(1.2\ mol)(3.5\ L)}{2.3\ mol}$$

$$V_2 = 1.8\ L$$

5. Pedro adds 1.25 moles of helium to a balloon that already contained 4.51 moles of helium creating a balloon with a volume of 8.97 liters. What was the volume of the balloon before the addition of the extra gas?

$+ n_1 = n_2$, V_2, n_1

$V_1 = ?$

$$1.25\ mol + 4.51\ mol = 5.76\ mol$$

$$n_1 \times \frac{V_1}{n_1} = \frac{V_2}{n_2} \times n_1 = \frac{(8.97\ L)(4.51\ mol)}{(5.76\ mol)}$$

$$V_1 = 7.02\ L$$

6. If I fill a balloon with 5.2 moles of gas and it creates a balloon with a volume of 23.5 liters, how many moles are in a balloon at the same temperature and pressure that has a volume of 14.9 liters?

n_1, V_1, V_2, n_2?

$$n_2 \times \frac{n_2 \times V_1}{n_1} = \frac{V_2 \times n_2 \times n_1}{n_2\ V_1} = \frac{(14.9\ L)(5.2\ mol)}{23.5\ L}$$

$$n_2 = 3.3\ mol$$

$PV = nRT$

$\frac{P_1V_1}{n_1T_1} = R = \frac{P_2V_2}{n_2T_2}$

$R = 8.314 \frac{kPa\,L}{mol\,K}$ or $0.0821 \frac{atm\,L}{mol\,K}$ $\quad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

Ideal Gas Law Practice Worksheet

Solve the following problems using the ideal gas law:

1) How many moles of gas does it take to occupy 120 liters at a pressure of 2.3 atmospheres and a temperature of 340 K?

n? V P T

$2.3\,atm \times \frac{101.3\,kPa}{1\,atm}$ $\quad P = 230\,kPa$

$\frac{PV}{RT} = \frac{nRT}{RT} = \frac{(230\,kPa)(120\,L)}{(8.314\,\frac{kPa\,L}{mol\,K})(340\,K)} = \underline{\underline{9.8\,mol}}$

2) If I have a 50 liter container that holds 45 moles of gas at a temperature of 200° C, what is the pressure inside the container?

$+273 = 473\,K$?

$\frac{PV}{V} = \frac{nRT}{V} = \frac{(45\,mol)(8.314\,\frac{kPa\,L}{mol\,K})(473\,K)}{50.L} = \underline{\underline{3.5 \times 10^3\,kPa}}$

3) It is not safe to put aerosol canisters in a campfire, because the pressure inside the canisters gets very high and they can explode. If I have a 1.0 liter canister that holds 2 moles of gas, and the campfire temperature is 1400° C, what is the pressure inside the canister?

why? KMT!!

$+273 = 1673\,K$

$\frac{PV}{V} = \frac{nRT}{V} = \frac{(2\,mol)(8.314\,\frac{kPa\,L}{mol\,K})(1673\,K)}{1.0\,L}$

$P = 2.8 \times 10^4\,kPa$

4) How many moles of gas are in a 30 liter scuba canister if the temperature of the canister is 300 K and the pressure is 200 atmospheres? $\times \frac{101.3\,kPa}{1\,atm} =$ $20260\,kPa$

$\frac{PV}{RT} = \frac{nRT}{RT} = \frac{(20260\,kPa)(30\,L)}{(8.314\,\frac{kPa\,L}{mol\,K})(300\,K)} = \underline{\underline{244\,mol}}$

5) I have a balloon that can hold 100 liters of air. If I blow up this balloon with 3 moles of oxygen gas at a pressure of 1 atmosphere, what is the temperature of the balloon?

$\frac{PV}{nR} = \frac{nRT}{nR} = \frac{(101.3\,kPa)(100\,L)}{(3\,mol)(8.314\,\frac{kPa\,L}{mol\,K})} = \underline{\underline{406\,K = T}}$