Name:______________________ Date:____________________

1 atm = 760mmHg = 101.3kPa = 14.7psi R(atm) = 0.0821, R(mmHg) = 62.396, R(kPa) = 8.3167

Torr = mmHg

Pressure conversion

A gas sample has a pressure of 800.0 mmHg. What is the pressure of this gas sample in atmospheres and in kilopascals.

$800 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} = 1.053 \text{ atm} \times \frac{101.3 \text{ kPa}}{1 \text{ atm}} = 106.63 \text{ kPa}$

A tank of oxygen is under a pressure of about 4.00×10^3 kPa. Express this pressure in millimeters of mercury.

$4.00 \times 10^3 \text{ kPa} \times \frac{760 \text{ mmHg}}{101.3 \text{ kPa}} = 3.001 \times 10^4 \text{ mmHg}$

Convert 1.69 atm to mmHg

$1.69 \text{ atm} \times \frac{760 \text{ mmHg}}{1 \text{ atm}} = 1284.4 \text{ mmHg}$

$P_1V_1 = P_2V_2$ Boyles law

3.00 L of a gas is at 740.0 mmHg pressure. What is its volume at standard pressure?

$V_1 = 3.0 \ l$ V_2

$P_1 = 740 \text{ mmHg}$ $P_2 = 760 \text{ mmHg}$

$\frac{P_1V_1}{P_2} = V_2 = \frac{740 \times 3 \ l}{760} = 2.921 \ l$

5.50 L of a gas is at 1.08 atm. What pressure is obtained when the volume is 10.0 L?

$V_1 = 5.50 \ l$ $V_2 = 10 \ l$

$P_1 = 1.08 \text{ atm}$ $P_2 ?$

$\frac{P_1V_1}{V_2} = P_2 = \frac{5.5 \ l \times 1.08 \text{ atm}}{10 \ l} = 0.594 \text{ atm}$

4.50 L of a gas was at an unknown pressure. However, at standard pressure, its volume was measured to be 8.00 L. What was the unknown pressure?

$V_1 = 4.5 \ l$ $P_2 = 1 \text{ atm}$ $P_1 = \frac{P_2V_2}{V_1} = \frac{1 \times 8 \ l}{4.5 \ l} = 1.78 \text{ atm}$

$P_1 = ?$ $V_2 = 8 \ l$

If we have 6 cm^3 of gas at a pressure of X and we increase the pressure to 2X, what volume will the gas occupy? Volume will be half, ratio of pressures is

$\frac{1x}{2x} = \frac{1}{2}$, $\frac{1}{2} \times$ volume $\frac{1}{2} \times 6 \text{ cm}^3 = 3 \text{ cm}^3$

A gas occupies 1.76 L at 1.00 atm. What will be the volume of this gas if the pressure becomes 3.00 atm?

$P_1 = 1$ atm $P_2 = 3$ atm $V_2 = \frac{P_1 V_1}{P_2} = \frac{1\text{ atm} \times 1.76\text{ li}}{3\text{ atm}} = 0.587$ li

$V_1 = 1.76$ li $V_2 = ?$

A gas occupies 12.2 liters at 0.860 atm. What is the pressure if the volume becomes 16.0 L?

$P_1 = 0.860$ atm $P_2 =$ $P_2 = \frac{P_1 V_1}{V_2} = \frac{0.860\text{ atm} \times 12.2\text{ li}}{16\text{ li}}$

$V_1 = 12.2$ li $V_2 = 16.0$ li

$= 0.656$ atm

500.0 mL of a gas is collected at 745.0 mm Hg. What will the volume be at standard pressure?

$P_1 = 745$ mmHg $P_2 = 760$ mm Hg

$V_1 = 500$ ml $V_2 = \frac{P_1 V_1}{P_2} = \frac{745\text{ mmHg} \times 500\text{ ml}}{760\text{ mmHg}} = 490.13$ ml

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

A gas is collected and found to fill 2.85 L at 35.0°C. What will be its volume at standard temperature?

$V_1 = 2.85$ l $V_2 = \frac{T_2 V_1}{T_1}$ $\frac{273\text{k} \times 2.85\text{ li}}{308\text{k}} = 2.526$ li

$T_1 = 35°C = 308$k $T_2 = 273$ k

6.40 L of a gas is collected at 50.0°C. What will be its volume upon cooling to 25.0°C?

$V_1 = 6.4$ li $V_2 = \frac{T_2 V_1}{T_1} = \frac{298\text{k} \times 6.4\text{ li}}{323\text{ k}} = 5.906$ li

$T_1 = 50°C = 323$ k $T_2 = 25°C = 298$ k

5.00 L of a gas is collected at 100 K and then allowed to expand to 40.0 L. What must the new temperature be in order to maintain the same pressure (as required by Charles' Law)?

$V_1 = 5$ li $V_2 = 40$ li

$T_1 = 100$k $T_2 = \frac{V_2 T_1}{V_1} = \frac{40\text{ li} \times 100\text{k}}{5\text{ li}} = 800$k

Calculate the decrease in temperature that must happen to shrink 8.00 L of gas at 20.0 °C to 2.00 L.

$V_1 = 8$ li $V_2 = 2.0$ li

$T_1 = 20°C = 293$k $T_2 = \frac{V_2 T_1}{V_1} = \frac{2\text{li} \times 293\text{k}}{8\text{ li}} = 73.25$k

very cold

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

800.0 mL of air is at 20.0 °C. What is the volume at 60.0 °C?

$V_1 = 800 ml$ $V_2 = \frac{V_1 T_2}{T_1} = \frac{800 ml \times 333 k}{293 k} = 909 ml$

$t_1 = 20°C = 293 k$ $T_2 = 60°C = 333$

A gas occupies 800.0 mL at a temperature of 27.0 °C. What is the volume at 132.0 °C?

Same as above $V_2 = \frac{V_1 T_2}{T_1} = \frac{800 ml \times 405 k}{300 k} = 1080 ml$

Gay- Lussac Law

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

15.0 L of a gas is found to exert 87.0 kPa at 25.0°C. What would be the required temperature (in Celsius) to change the pressure to standard pressure?

$P_1 = 87.0 kPa$ $P_2 = 101.3 kPa$ $\frac{101.3 kPa \times 298 k}{87 kPa} = 346.98 k$

$T_1 = 298 k$ $T_2 = ?$ $\frac{P_2 T_1}{P_1}$ $= 73.98°C$

5.00 L of a gas is collected at 28.0°C and 745.0 mmHg. When the temperature is changed to standard, what is the new pressure?

$P_1 = 745 mmHg$ $P_2 = \frac{P_1 T_2}{T_1} = \frac{745 mmHg \times 273 k}{301 k} = 675.7 mmHg$

$T_1 = 28°C = 301 k$ $T_2 = 273$

A gas has a pressure of 0.370 atm at 40.0 °C. What is the pressure at standard temperature?

$P_1 = 0.370 atm$ $P_2 =$ $\frac{P_1 T_2}{T_1} = \frac{0.37 atm \times 273 k}{313 k} = 0.323 atm$

$t_1 = 313 k$ $T_2 = 273$

If a gas is cooled from 323.0 K to 273.15 K and the volume is kept constant what final pressure would result if the original pressure was 750.0 mm Hg?

$P_1 = 750 mmHg$ $P_2 =$ $\frac{P_1 T_2}{T_1} = 633.9 mmHg$

$T_1 = 323 k$ $T_2 = 273 k$

If a gas in a closed container is pressurized from 15.0 atmospheres to 16.0 atmospheres and its original temperature was 25.0 °C, what would the final temperature of the gas be in Celsius due to heating the gas?

$P_1 = 15 atm$ $P_2 = 16 atm$ $\frac{P_2 T_1}{P_1} = 317.87 k$

$T_1 = 298 k$ $T_2 =$

A motorist fills his car tires to 32 lb/in^2 pressure at a temperature of 30°C. Assuming no change in volume, what will the pressure in the tires be when the motorist drives across Death Valley, with a pavement temperature of 78°C?

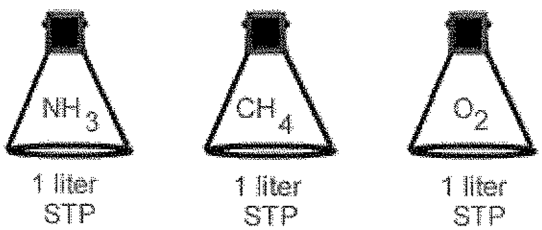
An 8.25 L sample of oxygen is collected at 25°C and 1.022 atm pressure. What volume will the gas occupy .940 atm and -15°C?

$V_1 = 8.25$ li $\quad V_2 = \quad \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad V_2 = \frac{P_1 V_1 T_2}{T_1 P_2}$

$T_1 = 298$ k $\quad T_2 = 258$

$P_1 = 1.022$ atm $\quad P_2 = 0.940 \quad \frac{1.022 \times 8.25 \text{ li} \times 258 \text{ k}}{298 \text{ k} \times 0.940} = 7.76$ li

Which flask contains the greatest number of molecules or are they all the same?



all the same

vol // moles // parts

$PV = nRT$

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

2.50 moles of nitrogen gas is placed in a closed 3.00 liter container at 25°C. If the temperature in the container is raised to 120°C, what will be the change in pressure?

P_i $\quad n = 2.5$ moles $\quad PV = nRT \quad P = \frac{nRT}{V} = \frac{2.5 \text{ mol} \times 0.0821 \times 298}{3 \text{ li}}$

$R = 0.0821 \quad V = 3$ li $\quad P_2 = ?$ $\quad P_1 = 20.39$ atm

$T_1 = 298$ k $\quad T_2 = 393 \quad P_2 = \frac{P_1 T_2}{T_1} = 26.89 - 20.39$

$\Delta = 6.5$ atm

The tires on tour de Francs road bikes can handle a pressure of 150 psi. What is this pressure in mm Hg? (By the way, these are very expensive tires. Don't do this on your bike at home...or your car!)

$150 \text{ psi} \times \frac{760 \text{ mmHg}}{14.7 \text{ psi}} = 7755 \text{ mmHg}$

If the tires from the previous problem are filled at 20°C and then get as hot as a 45°C road, what is the new pressure inside in psi?

$T_1 = 293$ k $\quad T_2 = 318$

$P_1 = 150$ psi $\quad P_2 = \frac{P_1 T_2}{T_1} = 162$ psi

325 mL of a gas at STP has a mass of .805 grams. What is the molar mass of the gaseous compound?

$V = 0.325$ li

$M = 0.805$ g $\quad M \text{ mass} = \frac{g}{mol} \quad 0.325 \text{ li} / 22.4 \frac{li}{mol} = 0.0145$ mol

$0.805 \text{ g} / 0.0145 \text{ mol} = 55$ g/mol

How many moles of gas would it take to fill an average person's lungs, total capacity of which is about 4.5 liters? Assume 1.00 atm pressure and 37.0°C.

V= 4.5 li T= 37°C = 310k PV=nRT

P= 1 atm n = $n = \frac{PV}{RT} = \frac{1 \text{ atm} \times 4.5 \text{ li}}{0.0821 \times 310k} = 0.177$ moles

R= 0.0821

What would the pressure in torr be of an ideal gas, if a 0.085 mole sample occupied a volume of 2610mL at a temperature of 2086.95K ?

n= 0.085 T: 2086.95k R= 62.396 PV=nRT

V = 2.610 li P:? 4241 torr 4241 torr = $P = \frac{nRT}{V} = \frac{0.085 \times 62.396 \times 2086.95k}{2.610 \text{ li}}$

How many moles of an ideal gas are in a volume of 3590mL with a temperature of 364.39K and a pressure of 2280torr ?

n= P= 2280 torr $n = \frac{PV}{RT} = \frac{2280 \times 3.59}{62.396 \times 364.39} = 0.36$ moles

V= 3590 li R= 62.396

T= 364.39k

What would the temperature in ~~degrees~~ K be of an ideal gas, if a 0.858 mole sample occupied a volume of 9.61liters at a pressure of 3.92atm ?

P = 3.92 atm R = 0.0821 PV=nRT $T = \frac{PV}{nR} = \frac{3.92 \text{ atm} \times 9.61 \text{ li}}{0.858 \times 0.0821}$

V = 9.61 li T = ? 534.8

n = 0.858 = 534.8 K

What would the temperature in degrees °C be of an ideal gas, if a 0.178 mole sample occupied a volume of 3800mL at a pressure of 4036torr ?

n= 0.178 mol R= 62.396 $\frac{PV}{nR} = \frac{4036 \text{ torr} \times 3.8}{0.178 \times 62.396} = 1381$ k

V= 3.8 li T= − 273

p= 4036 torr 1107 °c

How many moles of an ideal gas are in a volume of 8940mL with a temperature of -146°C and a pressure of 1.08atm ?

V= 8.94 P= 1.08 atm $n = \frac{PV}{RT} = \frac{1.08 \times 8.94}{0.0821 \times 127k} = 0.926$ mol

T= 127k R= 0.0821

How many moles of an ideal gas are in a volume of 1480mL with a temperature of 34.47K and a pressure of 996torr ?

n= ? $n = \frac{PV}{RT} = \frac{996 \times 1.48 \text{ li}}{62.396 \times 34.47}$

V= 1.480 li

T: 34.47k = 0.685 mols

P= 996 torr

R= 62.396

What would the pressure in atm be of an ideal gas, if a 0.541 mole sample occupied a volume of 3.09liters at a temperature of 230.27K ?

n= 0.541 mol   T= 230.27k   R= 0.0821

V= 3.09 li   P= ?

$P = \frac{nRt}{V} = \frac{0.541 \times 0.0821 \times 230.27}{3.09}$

= 3.31 atm

What would the pressure in atm be of an ideal gas, if a 0.012 mole sample occupied a volume of 1440mL at a temperature of 3376.37K ?

P=

n= 0.012 mol

V= 1.44 li

T= 3376.37

R= 0.0821

$P = \frac{nRt}{V} = \frac{0.012 \times 0.0821 \times 3376.37}{1.44}$

P= 2.31 atm