4/22/16

Gas Laws Hmwk #1

C 1 — 6 Temp + Pressure

D 2 — 7 diffusion

A 3 — 8 elastic

B 4 — 9 increase.

E 5 — 10 density

$V_1 P_1 = V_2 P_2$

11. $V_1 = 250ml$, $P_1 = 720mmHg$, 2sf, $V_2 = ?$, $P_2 = 750mmHg$

$\frac{(250ml)(720mmHg)}{750mmHg} = V_2$

$V_2 = \boxed{240ml}$

15. a) 293K b) 358K c) 258K d) 83K

18. $V_1 = 100ml$, $P_1 = 735mmHg$, 1sf, $V_2 = ?$, $P_2 = 700mmHg$

$(100ml)(735mmHg) = V_2(700mmHg)$

$V_2 = 105 \rightarrow \boxed{100ml}$

17. $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\div \frac{180ml}{316K} = \frac{135ml}{T_2}$

$V_1 = 180ml$, $T_1 = 43°C \rightarrow 316K$, $V_2 = 135ml$, $T_2 = ?$

$\frac{T_2(180ml)}{316K} = \frac{(135ml)(316K)}{180ml}$

$T_2 = 237K - 273 = \boxed{-36°C}$

19. $V_1 = 50.0L$, $T_1 = 300K\ (27°C)$, 2sf, $V_2 = ?$, $T_2 = 273K$

$(273K)\frac{50.0L}{300K} = \frac{V_2}{273K}$

$V_2 = 45.5 \rightarrow \boxed{46L}$

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

$V_1 = 1000\text{ml}$
$P_1 = 700\text{ mmHg}$
$T_1 = -23°C \rightarrow 250K$
$V_2 = ?$
$P_2 = 760\text{ mmHg}$
$T_2 = 273K$

$\frac{(273K)(1000ml)(700mmHg)}{(760mmHg)\,250K} = \frac{V_2(760\text{ mmHg})}{273K}$

$V_2 = 1005\ldots \rightarrow \boxed{1000\text{ml}}$

$(273 \times 1000 \times 700) \div (760 \times 250) =$

@STP

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23. $V_1 = 500\text{ml}$
$P_1 = 80.0\text{cmHg}$
(1st) $T_1 = 27°C \rightarrow 300K$
$V_2 = ?$
$P_2 = 75.0\text{cmHg}$
$T_2 = 270K$

$\frac{(500ml)(80.0cmHg)}{300K} = \frac{V_2(75.0cmHg)}{270K}$

$V_2 = 480 \rightarrow \boxed{500ml}$

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25. $V_1 = 350\text{ml}$
$P_1 = 740.0\text{mmHg}$
$T_1 = 25°C \rightarrow 298K$
$V_2 = ?$
$P_2 = 760.\text{mmHg}$
$T_2 = 273K$

multiply

$\frac{(35.0ml)(740.0mmHg)}{298K} = \frac{V_2(760mmHg)}{273K}$ $\div (760 \times 298) =$

$V_2 = 31.2 \rightarrow \boxed{31\text{ml}}$

STP | Standard Temp. 0°C 273K | Standard Pressure 1 ATM = 101.3 kPa = 760 mmHg

742 mmHg = ? ATM

$742\ mmHg \times \frac{1\ ATM}{760\ mmHg} = 0.976\ ATM$

Boyle's Law $V_1P_1 = V_2P_2$

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

Combined Gas Law $\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2}$

* Temp must be in Kelvin

$PV = nRT$ (if given moles)

$PV_{mm} = gRT$

↑ molar mass ↑ grams

Ideal Gas Law

R = gas Laws constant

$0.0821 \frac{L \cdot atm}{mol\ K}$	$8.31 \frac{L \cdot kPa}{mol\ K}$	$62.4 \frac{L \cdot mmHg}{mol\ K}$

(!!) not memory work

What is the pressure (need) in kPa of a container that holds 5.2 L (V) of 60.0 g (mass) of neon gas at 27°C (300 K T)? 2 sf

20.18 g/mol

$P((5.2L)(20.18\ g/mol)) = (60.0g)(8.31 \frac{L \cdot kPa}{mol\ K})(300K)$

$P = 1425 \rightarrow 1400\ kPa$

P = ?
V = 5.2 L
m.m. = 20.18 g/mol
g = 60.0 g
R = $8.31 \frac{L \cdot kPa}{mol\ K}$
T = 300 K

What is the temperature if 36.0 mol of a gas are held at 739 (P) mmHg in a 800.0 L container? 3 sf

P = 739 mmHg
V = 800.0 L
n = 36.0 mol
R = $62.4 \frac{L \cdot mmHg}{mol\ K}$
T = ?

$(739\ mmHg)(800.0L) = (36.0\ mol)(62.4 \frac{L \cdot mmHg}{mol\ K})(?T)$

$T = 263K$

Dalton's Law of Partial Pressure:

Total Pressure = the sum of all partial pressures.

$P_{TOT} = P_1 + P_2 + \ldots\ldots$

Density of a gas at STP

$D_{STP} = \frac{\text{molar mass}}{\text{molar volume}}$

Density of water vapor at STP?

$D_{STP} = \frac{18.02\ g/mol}{22.4\ L/mol} = \boxed{0.804\ g/L}$

Volume changes if not working at STP. Use combined gas Law to calculate Volume $\boxed{V_1 = 22.4L \quad T_1 = 273K \quad P_1 = \text{standard pressure}}$

V_2 = new vol. $T_2 + P_2$ come from word problem

What is the density of water vapor at 25.0°C and 1.02 ATM?

1st use combined gas Law to find V_2, then use V_2 to calculate density.

$$\frac{(22.4L)(1\ ATM)}{273K} = \frac{V_2(1.02\ ATM)}{298K} \qquad \boxed{V_2 = 24.0L}$$

$D_{new} = \frac{18.02g}{24.0L} = \boxed{0.751\ g/L}$

Hmwk: 1-8 on Ideal Gas Law Sheet & JLab
& Study for quiz

mass of Mg = **0.0218g Mg** m → v **1 Mg + 2HCl(aq) → 1 $MgCl_2$ + 1 H_2(g)**

$$0.0218\text{g Mg} \times \frac{1\text{mol Mg}}{24.31\text{g Mg}} \times \frac{1\text{mol } H_2}{1\text{mol Mg}} \times \frac{22.4\text{L } H_2}{1\text{mol } H_2} = 0.0201\text{ L } H_2$$

Lab

$$0.0201\text{L} \times \frac{1000\text{ ml}}{1\text{ L}} = \boxed{20.1\text{ml}}$$

@ STP

What is the density of H_2(g) at STP?

$$D_{STP} = \frac{2.02\text{g}}{22.4\text{L}} = \boxed{0.0902\text{g/L}}$$

What is the density of H_2 at 25.0°C and 763.5mmHg?

1st use combined gas Law to find V_2.

2nd use V_2 to find D_{new}.

$$\frac{(22.4\text{L})(760\text{mmHg})}{273\text{K}} = \frac{V_2(763.5\text{ mmHg})}{298\text{K}} \qquad V_2 = 24.3\text{L}$$

$$D_{new} = \frac{2.02\text{g}}{24.3\text{L}} = \boxed{0.0831\text{ g/L}}$$

1. 0.0218g Mg
2. 25.0°C (T_1)
3. 763.5 mmHg
4. 20.7 ml (V_1)
5. 23.8 mmHg
6. 739.7 mmHg (P_1)
7. * STP V_2 = ?