سنتر فيوتشر

Subject: كيمياء «اعدادي»

Chapter: حل شيت «الغازات»

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Sheet (1) gases

1- Calculate the volume in liters occupied by 7.80 g of NH_3 at STP.

2- If 30.0 L of oxygen are cooled from 200°C to 1°C at constant pressure, what is the new volume of oxygen?

3- If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?

4- A small bubble rises from the bottom of a lake, where the temperature and pressure are 8°C and 6.4 atm, to the water's surface, where the temperature is 25°C and the pressure is 1 atm. Calculate the final volume of the bubble if its initial volume was 2.1 mL.

5- A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, to the water's surface, where the temperature is 25°C and the pressure is 0.95 atm. Calculate the final volume of the bubble if its initial volume was 2.1 mL.

6- Calculate the density of Br_2 (g) at 59.0°C and 1.00 atm pressure.

7- Calculate the density, in g/L, of SF_6 gas at 27°C and 0.500 atm pressure.

8- Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm^3 at 97°C. The pressure of the chloroform is 728 mmHg.

9- Determine the molar mass of Freon-11 gas if a sample weighing 0.597 g occupies 100. cm^3 at 95°C, and 1,000. mmHg.

10- Sodium azide (NaN3) isused in some, automobile air bags. the decomposition of NaN_3 as follows :

$$2\,NaN_3\,(S) \rightarrow 2\,Na\,(S) + 3\,N_2\,(g)$$

The nitrogen gas produced quickly inflates the bag between the driver and the windshield and dashed horde .calculate the volume of nitrogen generated at 80 °C and 823 mmHg by the decomposition of 60 g of Sodium azide (NaN_3).

11- Aqueous lithium hydroxide is used to purify air in spacecraft and submarines /because it absorbs carbon dioxide , which is an end product of metabolism , according to the equation :

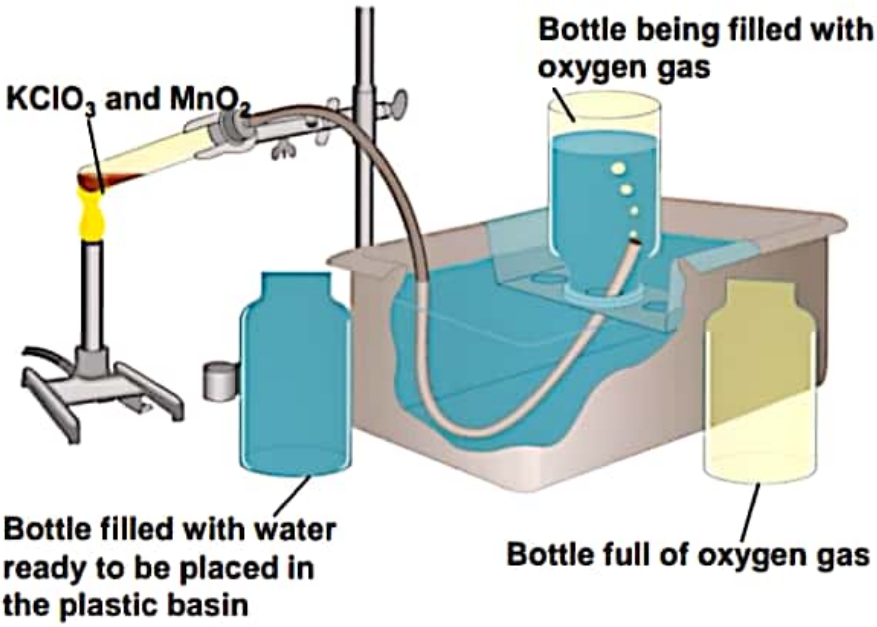
$$2\,LiOH\,(aq) + CO_2\,(g) \rightarrow Li_2CO_3\,(aq) + H_2O\,(L)$$

A solution of lithium hydroxide (LiOH) of negligible volume is introduced into the cabin. Eventually the pressure of CO2 falls to 1.2×10^{-4} atm. how many grams of lithium carbonate are formed at this process.

12- A mixture of three gases has a total pressure of 1,380 mmHg at 298 K. The mixture is analyzed and is found to contain 1.27 mol CO_2, 3.04 mol CO, and 1.50 mol Ar. What is the partial pressure of Ar?

13- A sample of carbon monoxide gas was collected in a 2.0 L flask by displacing water at 28°C and 810 mmHg. Calculate the number of CO molecules in the flask. The vapor pressure of water at 28°C is 28.3 mmHg.

14- Oxygn gas generated by the decomposition of potassium chlorates is collected as shown in the figure (1). The volume of oxygen collected at 24 °C and atmospheric pressure of 762 mmHg is 128 mL. Calculate the mass in grams of oxygen gas obtained. The pressure of the water vapor at 24 °C is 22.4 mmHg.



15- 9.45 g of liquid hexane (C_6H_{14}) is introduced into a 10.0 L vessel containing 13.15 atm of oxygen gas at 21°C and ignited, yielding carbon dioxide and water. If the vessel is then cooled to -10°C, what will be the gas pressure inside the vessel?

Sheet of Gases

1) V ??

$m_{NH_3} = 7.8$ gm

at S.T.P $\Rightarrow P = 1$ atm & $T = 0^\circ C + 273 = 273$ k

no. of moles of $NH_3 = \frac{m}{\mu} = \frac{7.8}{17}$

$$V = \frac{nRT}{P} = \frac{(\frac{7.8}{17})\,mol * 0.082\ \frac{L.atm}{mol\,k} * 273\,k}{1\ atm} = 10.27\ L$$

2) $V_1 = 30$ L

$T_1 = 200^\circ C + 273 = 473$ k

$T_2 = 1^\circ C + 273 = 274$ k

P is Constant

V_2 ??

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

$$\frac{30}{473} = \frac{V_2}{274} \rightarrow V_2 = 17.4\ L$$

3) $P_2 = 4P_1$

$T_2 = 2T_1$

$V_2 = ??\ V_1$

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

$$\frac{P_1V_1}{T_1} = \frac{4P_1 * V_2}{2T_1}$$

$$V_1 = 2V_2$$

$$V_2 = \frac{1}{2}V_1$$

4)

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

$$\frac{6.4 * 2.1}{281} = \frac{1 * V_2}{298}$$

$$V_2 = 14.25 \text{ ml}$$

$T_2 = 25^\circ C + 273 = 298 \text{ k}$
$P_2 = 1 \text{ atm}$
$V_2 = ??$

$T_1 = 8^\circ C + 273 = 281 \text{ k}$
$P_1 = 6.4 \text{ atm}$
$V_1 = 2.1 \text{ ml}$

5)

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

$$\frac{3 * 2.1}{277} = \frac{0.95 * V_2}{298}$$

$$V_2 = 7.13 \text{ ml}$$

$T_2 = 25^\circ C + 273 = 298 \text{ k}$
$P_2 = 0.95 \text{ atm}$
V_2 ??

$T_1 = 4^\circ C + 273 = 277 \text{ k}$
$P_1 = 3 \text{ atm}$
$V_1 = 2.1 \text{ ml}$

6) $M_{Br_2} = 159.8 \text{ gm/mol}$

$T = 59^\circ C + 273 = 332 \text{ k}$
$P = 1 \text{ atm}$
d ??

$$d = \frac{PM}{RT}$$

$$d = \frac{1 \text{ atm} * 159 \text{ gm/mol}}{0.082 \frac{\text{L.atm}}{\text{mol k}} * 332 \text{k}} = 5.84 \text{ gm/L}$$

7) d ??

$T = 27^\circ C + 273 = 300\ k$

$P = 0.5\ atm$

$M_{SF_6} = 32 + (6 * 19) = 146\ gm/mol$

$$d = \frac{PM}{RT}$$

$$d = \frac{0.5\ atm * 146\ \frac{gm}{mol}}{0.082\ \frac{L.atm}{mol\ k} * 300\ k} = 2.96\ gm/L$$

8) M ??

$m = 0.389\ gm$

$U = 102\ cm^3 = 102 * 10^{-3}\ L$

$T = 97^\circ C + 273 = 370\ k$

$P = 728\ mmHg = \frac{728}{760}\ atm$

$$PU = nRT$$

$$PU = \frac{m}{M}RT$$

$$M = \frac{mRT}{PV}$$

$$M = \frac{0.389\ gm * 0.082\ \frac{L.atm}{mol\ k} * 370\ k}{\frac{728}{760}\ atm * 102 * 10^{-3}\ L}$$

$$= 120.8\ gm/mol$$

9) M ??

$m = 0.597$ gm

$V = 100\ cm^3 = 100 * 10^{-3}$ L

$T = 95^\circ C + 273 = 368$ k

$P = 1000$ mmHg $= \frac{1000}{760}$ atm

$$M = \frac{mRT}{PV}$$

$$M = \frac{0.597\ gm * 0.082 \frac{L.atm}{mol\ k} * 368\ k}{\frac{1000}{760}\ atm * 100 * 10^{-3}\ L}$$

$$= 136.9 \quad gm/mol$$

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10) $T = 80^\circ C + 273 = 353$ k

$P = 823$ mmHg $= \frac{823}{760}$ atm

$m_{NaN_3} = 60.0$ gm

V_{N_2} ??

$$n_{NaN_3} = \frac{m_{NaN_3}}{M_{NaN_3}} = \frac{60}{23+3(14)} = \frac{60}{65} \text{ mole}$$

$$2NaN_3 \longrightarrow 2Na + 3N_2(g)$$

2 mol — 3 mol

$\frac{60}{65}$ mol — ??

$$n_{N_2} = \frac{3}{2} * \left(\frac{60}{65}\right) = 1.38 \text{ mole}$$

for N_2 gas $\longrightarrow PV = nRT$

$$\frac{823}{760}\ atm * V_{N_2} = 1.38\ mol * 0.082 \frac{L.atm}{mol\ k} * 353\ k$$

$$V_{N_2} = 37\ L$$

11) for CO_2 gas :- $P_1 = 79.9 * 10^{-4}$ atm

$V = 2.4 * 10^5$ L

$T = 312$ K

$P_2 = 1.2 * 10^{-4}$ atm

$\Delta P = [79.9 * 10^{-4}] - [1.2 * 10^{-4}] = 78.7 * 10^{-4}$ atm

$m_{Li_2CO_3}$??

$M_{Li_2CO_3} = 73.89$ gm/mole

Li → 6.9
C → 12
O → 16

من المعادلة العامة للغازات $PV = nRT$

$$n = \frac{PV}{RT}$$

at Constant T & V $\Rightarrow$ $\Delta n = \Delta P \left(\frac{V}{RT}\right)$

$$\Delta n = 78.7 * 10^{-4}\ atm * \left(\frac{2.4 * 10^5\ L}{0.082\ \frac{L.atm}{mol\ k} * 312\ k}\right)$$

$\Delta n = 73$ mole

$$2LiOH_{(aq)} + CO_{2\,(g)} \longrightarrow Li_2CO_{3\,(aq)} + H_2O_{(L)}$$

1 mol : 1 mol

73 mol : 73 mol

no. of moles of Li_2CO_3 = $\frac{\text{mass}}{\text{molar mass}}$

$$73\ \text{mole} = \frac{m_{Li_2CO_3}}{73.89}$$

$m_{Li_2CO_3} = 5.4 * 10^3$ gm

12) $P_T = 1,380 \text{ mmHg} = \frac{1,380}{760} \text{ atm} = 1.8 \text{ atm}$

$n_{Co_2} = 1.27 \text{ mol}$

$n_{Co} = 3.04 \text{ mol}$

$n_{Ar} = 5.81 \text{ mol}$

$$P_{Ar} = \frac{n_{Ar}}{n_T} * P_T$$

$$P_{Ar} = \frac{1.5}{5.81} * 1.8 \text{ atm} = 0.46 \text{ atm}$$

13) $V_{O_2} = 2 \text{ L}$

$T = 28^\circ C + 273 = 301 \text{ k}$

$P_T = 810 \text{ mmHg} = \frac{810}{760} \text{ atm}$

$P_{H_2O} = 28.3 \text{ mmHg}$

no. of molecules of Co ??

$$P_T = P_{Co} + P_{H_2O}$$

$$810 \text{ mmHg} = P_{Co} + 28.3 \text{ mmHg}$$

$$P_{Co} = 781.7 \text{ mmHg} = \frac{781.7}{760} \text{ atm}$$

For Co gas :- $PV = nRT$

$$n = \frac{PV}{RT}$$

$$n = \frac{\frac{781.7}{760} \text{ atm} * 2 \text{ l}}{0.082 \frac{\text{l.atm}}{\text{mol k}} * 301 \text{ k}} = 0.08 \text{ mole}$$

no. of molecules of Co $= 0.08 * 6.02 * 10^{23}$

$= 5 * 10^{22}$ molecules

14) $V_{O_2} = 128\ ml = 0.128\ L$

$T_{O_2} = 24°C + 273 = 297\ k$

$P_T = 762\ mmHg = \frac{762}{760}\ atm$

m_{O_2} ??

$P_{H_2O} = 22.4\ mmHg$

$$P_T = P_{H_2O} + P_{O_2}$$

$$762\ mmHg = 22.4\ mmHg + P_{O_2}$$

$$P_{O_2} = 739.6\ mmHg = \frac{739.6}{760}\ atm$$

For O_2 gas $\quad PV = nRT$

$$PV = \frac{m}{M}RT$$

$$\frac{739.6}{760}\ atm * 0.128\ L = \frac{m_{O_2}}{32} * 0.082\ \frac{L.atm}{mol\ k} * 297\ k$$

$$m_{O_2} = 0.164\ gm$$

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15) $m_{C_6H_{14}} = 9.45\ gm$

$V = 10\ L$

$P_1 = 13.15\ atm$

$T_1 = 21°C + 273 = 294\ k$

$T_2 = -10°C + 273 = 263\ k$

$P_2 = ??$

V is Constant $\Rightarrow \quad \frac{P_1}{T_1} = \frac{P_2}{T_2}$

$$\frac{13.15}{294} = \frac{P_2}{263}$$

$P_2 =$ $\quad atm$