# Dalton's Law Of Partial Pressure Problems

1) **The volume of hydrogen collected over water is 453 mL at 18° C and 780. mm Hg. What is its volume dry at STP?**

2) **A 423 mL sample of dry oxygen at STP is transferred to a container over water at 22° C and 738 mm Hg. What is the new volume of the oxygen?**

3) **Calculate the mass of 400. mL of carbon dioxide collected over water at 30.° C and 749 mm Hg.**

4) **50.0 mL of dry fluorine at 20.0° C and 795 mm Hg will occupy what volume over water at the same temperature and pressure?**

# Solutions

1) $P_1 = P_T = P_{hyd} + P_{water} = 780.$ mm Hg  $P_2 = 760$ mm Hg

$P_{hyd} = 780.$ mm Hg – 15.5 mm Hg = 764 mm Hg

$V_1 = 453$ mL  $V_2 = ?$

$T_1 = 18°$ C + 273 = 291 K  $T_2 = 0°$ C + 273 = 273 K

$P_1V_1/T_1 = P_2V_2/T_2$

$V_2 = P_1V_1/T_1 \times T_2/P_2$

$V_2 = 780.$ ~~mm~~ x 453 mL x 273 ~~K~~/(291 ~~K~~ x 760 ~~mm~~) = 436 mL $H_2$

2) $P_1 = 760$ mm Hg  $P_2 = P_T = P_{oxy} + P_{water} = 738$ mm – 19.8 mm Hg

$P_2 = 718$ mm Hg

$V_1 = 423$ mL  $V_2 = ?$

$T_1 = 0.0°$C + 273 = 273 K  $T_2 = 22°$ C + 273 = 295 K

$P_1V_1/T_1 = P_2V_2/T_2$

$V_2 = P_1V_1/T_1 \times T_2/P_2$

$V_2 = 760$ ~~mm~~ x 423 mL x 295 ~~K~~/(273 ~~K~~ x 718 ~~mm~~) = 484 mL $O_2$

3) $P_T = P_{gas} + P_{water} = 749$ mm Hg      $R = 0.0821$ L·atm/mol·K

$P_{gas} = 749$ mm Hg – 31.8 mm Hg = 717 mm Hg

$V = 400.0$ L

$T = 30.°$ C + 273 = 303 K

$PV = nRT$

$n = PV/RT$

$n = 717 \text{ mm} \times 1 \text{ atm}/760 \text{ mm} \times 400.0 \text{ mL} \times 1 \text{ L}/10^3 \text{ mL}/(0.0821 \text{ L·atm/mol·K} \times 303 \text{ K})$

$n = 0.0152$ mol $CO_2$

$m = 0.0152 \text{ mol } CO_2 \times 44.01 \text{ g } CO_2/1 \text{ mol } CO_2 =$ 0.669 g $CO_2$

4) $P_1 = 795$ mm Hg      $P_2 = P_T = P_{gas} – P_{water}$

$P_2 = 795$ mm Hg – 17.5 mm Hg = 778 mm Hg

$V_1 = 50.0$ mL      $V_2 = ?$

$T_1 = 20.0°$ C + 273 = 293 K      $T_2 = T_1 = 293$ K

$P_1V_1/T_1 = P_2V_2/T_2$

$V_2 = P_1V_1/P_2$

$V_2 = 795 \text{ mm} \times 50.0 \text{ mL}/778 \text{ mm} =$ 51.1 mL