(white)

CHM151 Quiz4 25 Pts Fall 2018 Name: Key

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R = 62.4 L·torr/mol·K R = 0.0821 L·atm/mol·K PV = nRT $P_1V_1T_2 = P_2V_2T_1$

Atomic masses: C 12.01, H 1.008, N 14.01

1. Calculate the volume occupied by 35.2 g of methane gas (CH_4) at 25°C and 1.0 atm. R = 0.08206 L·atm/K·mol.

P = 1.0 atm

V = ? L

$n = \frac{35.2\ g}{16.04\ g/mol} = 2.194\ mol$

R = 0.08206 L·atm/mol·K

T = 25 + 273 = 298 K

$V = \frac{nRT}{P}$

$V = \frac{(2.194\ mol)\left(0.08206\ \frac{L \cdot atm}{mol \cdot K}\right)(298\ K)}{(1.0\ atm)}$

V = 53.7 L

2. The concentration of oxalate ion ($C_2O_4^{2-}$) in a sample can be determined by titration with a solution of permanganate ion (MnO_4^-) of known concentration. The net ionic equation for this reaction is

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

A 30.00 mL sample of an oxalate solution is found to react completely with 21.93 mL of a 0.1725 M solution of MnO_4^-. What is the oxalate ion concentration in the sample?

$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

21.93 mL, 0.1725 mmol/mL

30.00 mL, ? mol/L

$\frac{21.93\ mL\ MnO_4^-}{30.00 \times 10^{-3}\ L\ C_2O_4^{2-}} \left|\frac{0.1725\ mmol\ MnO_4^-}{1000\ mL\ MnO_4^-}\right| \frac{5\ mol\ C_2O_4^{2-}}{2\ mol\ MnO_4^-} = 0.3152\ \frac{mol\ C_2O_4^{2-}}{L\ C_2O_4^{2-}}$

3. Calculate the density, in g/L, of N_2 gas at 35°C and 0.98 atm pressure.

P = 0.98 atm

V = ? L

n = 1 mol (28.02 g)

R = 0.0821 L·atm/mol·K

T = 35 + 273 = 308 K

$V = \frac{nRT}{P} = \frac{(1\ mol)\left(0.0821\ \frac{L \cdot atm}{mol \cdot K}\right)(308\ K)}{0.98\ atm}$

V = 25.8 L

$D = \frac{28.02\ g}{25.8\ L} = 1.09\ g/L$

4. At what temperature will a sample of oxygen gas with a volume of 0.110 L at 12°C and 822 mmHg occupy a volume of 345 mL at a pressure of 578 mm Hg? Assume the amount of the oxygen gas does not change.

P_1 = 822 mm Hg P_2 = 578 mm Hg

V_1 = 0.110 L V_2 = 345 mL

T_1 = 12 + 273 = 285 K T_2 = ?

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

$T_2 = \frac{(578\ mm\ Hg)(0.345\ L)(285\ K)}{(822\ mm\ Hg)(0.110\ L)}$

T_2 = 629 K or 355 °C

5. A sample of oxygen gas has a volume of 545 mL at 35°C. The gas is heated to 151°C at constant pressure in a container that can contract or expand. What is the final volume of the oxygen gas?

$P_1 = P_2$

V_1 = 545 mL V_2 = ?

T_1 = 308 K T_2 = 424 K

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

$V_2 = \frac{(545\ mL)(424\ K)}{(308\ K)} = 750\ mL$