

(white)

CHM151 Quiz4 25 Pts Fall 2018

Name:

Key

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$R = 62.4 \text{ L}\cdot\text{torr}/\text{mol}\cdot\text{K}$

$R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

$PV = nRT$

$P_1V_1T_2 = P_2V_2T_1$

Atomic masses: C 12.01, H 1.008, N 14.01

1. Calculate the volume occupied by 35.2 g of methane gas ( $\text{CH}_4$ ) at  $25^\circ\text{C}$  and 1.0 atm.  $R = 0.08206 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$ .

$P = 1.0 \text{ atm}$

$V = ? \text{ L}$

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

$R = 0.08206 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

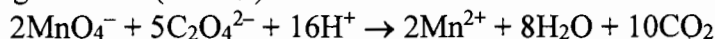
$T = 25 + 273 = 298 \text{ K}$

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

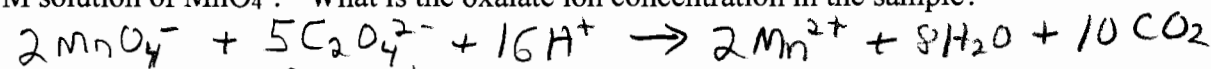
$V = \frac{(2.194 \text{ mol})(0.08206 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K})(298 \text{ K})}{(1.0 \text{ atm})}$

$V = 53.7 \text{ L}$

2. The concentration of oxalate ion ( $\text{C}_2\text{O}_4^{2-}$ ) in a sample can be determined by titration with a solution of permanganate ion ( $\text{MnO}_4^-$ ) of known concentration. The net ionic equation for this reaction is



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  $\text{MnO}_4^-$ . What is the oxalate ion concentration in the sample?



$21.93 \text{ mL}$

$30.00 \text{ mL}$

$? \text{ mol/L}$

$0.1725 \text{ mol/L}$

$$\frac{30.00 \times 10^{-3} \text{ L}}{\text{C}_2\text{O}_4^{2-}} \times \frac{21.93 \text{ mL MnO}_4^-}{0.1725 \text{ mol/L MnO}_4^-} \times \frac{5 \text{ mol C}_2\text{O}_4^{2-}}{2 \text{ mol MnO}_4^-} = 0.3152 \text{ mol/L C}_2\text{O}_4^{2-}$$

3. Calculate the density, in g/L, of  $\text{N}_2$  gas at  $35^\circ\text{C}$  and 0.98 atm pressure.

$P = 0.98 \text{ atm}$

$V = ? \text{ L}$

$n = 1 \text{ mol} (28.02 \text{ g})$

$R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K}$

$T = 35 + 273 = 308 \text{ K}$

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

$V = 25.8 \text{ L}$

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

4. At what temperature will a sample of oxygen gas with a volume of 0.110 L at  $12^\circ\text{C}$  and 822 mmHg occupy a volume of 345 mL at a pressure of 578 mmHg? Assume the amount of the oxygen gas does not change.

$P_1 = 822 \text{ mmHg}$

$P_2 = 578 \text{ mmHg}$

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

$V_1 = 0.110 \text{ L}$

$V_2 = 345 \text{ mL}$

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

$T_1 = 12 + 273 = 285 \text{ K}$

$T_2 = ?$

$T_2 = 629 \text{ K} \text{ or } 355^\circ\text{C}$

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

$P_1 = P_2$

$V_1 = 545 \text{ mL}$

$V_2 = ?$

$T_1 = 308 \text{ K}$

$T_2 = 424 \text{ K}$

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

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