Chemistry 141 Name Key

Dr. Cary Willard

Quiz 4a (20 points) March 1, 2012

All work must be shown to receive credit. Give answer to correct number of significant figures. PV=nRT, R = 0.0821 L atm/mol K = 62.4 l torr/mol K, 760 torr = 760 mm Hg = 14.7 psi = 101.3 kPa = 1 atm

1. (4 points) The air pressure in Denver, Colorado is approximately 12.1 psi. Determine the pressure in torr and atm.

$$12.1 psi×\frac{760 torr}{14.7 psi}=626 torr$$

$$12.1 psi×\frac{1 atm}{14.7 psi}=0.823 atm$$

1. (5 points) A syringe containing 43.2 mL of oxygen gas is cooled from 79.3oC to 20.4oC. What is the final volume of the oxygen gas?

$$PV=nRT\rightarrow \frac{nR}{P}=constant=\frac{V}{T}\rightarrow \frac{V\_{1}}{T\_{1}}=\frac{V\_{2}}{T\_{2}}\rightarrow V\_{2}=V\_{1}\left(\frac{T\_{2}}{T\_{1}}\right)$$

$$V\_{2}=V\_{1}\left(\frac{T\_{2}}{T\_{1}}\right)=43.2 mL\left(\frac{293.6 K}{352.5 K}\right)=36.0 mL$$

1. (5 points) An experiment shows that a 94.2 mL gas sample has a mass of 0.420 g at a pressure of 639 mm Hg and a temperature of 51.0 oC. What is the molar mass of the gas?

$$PV=nRT\rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(639 torr\right)mol K}{\left(62.4 L torr\right)\left(324.2K\right)}=\frac{0.0316 mol}{L}$$

$$molar mass=\frac{g gas}{mol}=\left(\frac{1 L}{0.0316 mol}\right)\left(\frac{0.420 g}{0.0942 L}\right)=\frac{141 g}{mol}$$

1. (6 points) Consider the following reaction

2 H2O*(g)* 🡪 2 H2*(g)* + O2*(g)*

What mass of H2O is required to form 3.59 L of O2 at a temperature of 392K and a pressure of 0.842 atm?

$$?L H\_{2}O=3.59 L O\_{2}×\frac{2 L H\_{2}O}{1 L O\_{2}}=7.18 L H\_{2}O$$

$$PV=nRT\rightarrow n=\frac{PV}{RT}=\frac{\left(0.842 atm\right)\left(7.18 L\right)mol K}{\left(0.0821 L atm\right)\left(392K\right)}=0.188 mol H\_{2}O $$

$$0.188 mol H\_{2}O×\frac{18.02 g H\_{2}O}{1 mol H\_{2}O}=3.39 g H\_{2}O$$

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Quiz 4b (20 points) March 1, 2012

All work must be shown to receive credit. Give answer to correct number of significant figures. PV=nRT, R = 0.0821 L atm/mol K = 62.4 l torr/mol K, 760 torr = 760 mm Hg = 14.7 psi = 101.3 kPa = 1 atm

1. (4 points) The air pressure in Taos, New Mexico is approximately 12.4 psi. Determine the pressure in torr and atm.

$$12.4 psi×\frac{760 torr}{14.7 psi}=641 torr$$

$$12.4 psi×\frac{1 atm}{14.7 psi}=0.843 atm$$

1. (5 points) A syringe containing 68.4 mL of oxygen gas is cooled from 79.3oC to 20.4oC. What is the final volume of the oxygen gas?

$$PV=nRT\rightarrow \frac{nR}{P}=constant=\frac{V}{T}\rightarrow \frac{V\_{1}}{T\_{1}}=\frac{V\_{2}}{T\_{2}}\rightarrow V\_{2}=V\_{1}\left(\frac{T\_{2}}{T\_{1}}\right)$$

$$V\_{2}=V\_{1}\left(\frac{T\_{2}}{T\_{1}}\right)=68.4 mL\left(\frac{293.6 K}{352.5 K}\right)=57.0 mL$$

1. (5 points) An experiment shows that a 94.2 mL gas sample has a mass of 0.396 g at a pressure of 831 mm Hg and a temperature of 51.0 oC. What is the molar mass of the gas?

$$PV=nRT\rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(831 torr\right)mol K}{\left(62.4 L torr\right)\left(324.2K\right)}=\frac{0.0411 mol}{L}$$

$$molar mass=\frac{g gas}{mol}=\left(\frac{1 L}{0.0411 mol}\right)\left(\frac{0.396 g}{0.0942 L}\right)=\frac{102 g}{mol}$$

1. (6 points) Consider the following reaction

2 H2O*(g)* 🡪 2 H2*(g)* + O2*(g)*

What mass of H2O is required to form 4.06 L of O2 at a temperature of 392 K and a pressure of 0.586 atm?

$$?L H\_{2}O=4.06 L O\_{2}×\frac{2 L H\_{2}O}{1 L O\_{2}}=8.12 L H\_{2}O$$

$$PV=nRT\rightarrow n=\frac{PV}{RT}=\frac{\left(0.586 atm\right)\left(8.12 L\right)mol K}{\left(0.0821 L atm\right)\left(392K\right)}=0.148 mol H\_{2}O $$

$$0.148 mol H\_{2}O×\frac{18.02 g H\_{2}O}{1 mol H\_{2}O}=2.66 g H\_{2}O$$