Chemistry 141 Name

Dr. Cary Willard

Quiz 6A (20 points) March 3, 2009

Data: PV=nRT R = 62.4 L torr/mol K = 0.0821 L atm/mol K

1. (5 points) A certain amount of gas at 25oC and at a pressure of 0.800 atm is contained in a glass vessel. Suppose that the vessel can withstand a pressure of 2.00 atm. How high can n

P1 = 0.800 atm

P2 = 2.00 atm

T1= 25oC = 298 K

T2= ???

$$\frac{P\_{1}V\_{1}}{n\_{1}T\_{1}}=\frac{P\_{2}V\_{2}}{n\_{2}T\_{2}}\rightarrow \rightarrow \frac{P\_{1}}{T\_{1}}=\frac{P\_{2}}{T\_{2}}\rightarrow \rightarrow T\_{2}=T\_{1}\left(\frac{P\_{2}}{P\_{1}}\right)$$

$$T\_{2}=298 K\left(\frac{2.00 atm}{0.800 atm}\right)=745 K or 472 ℃$$

1. (5 points) Ozone molecules in the stratosphere absorb much of the harmful radiation from the sun. Typically, the temperature and pressure of ozone in the stratosphere are 250 K and 1.0 x 10-2 atm, respectively. How many ozone molecules are present in 1.0 L of air under these conditions?

 P = 1.0 x 10-2 atm

 T = 250 K

 V = 1.0 L

 R = 0.0821 L atm/mol K

 $PV=nRT \rightarrow \rightarrow n=\frac{PV}{RT}=\frac{\left(1.0×10^{-2}atm\right)\left(1.0 L\right)mol K}{\left(0.0821 L atm\right)\left(250 K\right)}$

$$=4.9×10^{-4}mol ozone$$

$$?molecules ozone=4.9×10^{-4}mol ozone×\frac{6.022 ×10^{23}molecules ozone}{1 mol ozone}$$

$$=2.9×10^{20}molecules ozone$$

1. (5 points) Consider the formation of nitrogen dioxide from nitric oxide and oxygen:

2 NO(g) + O2(g) 🡪 2 NO2(g)

If 9.0 L of NO are reacted with excess O2 at STP, what is the volume in liters of the NO2 produced?

$$?L NO\_{2}=9.0 L NO×\frac{1 L NO\_{2}}{1 L NO}=9.0 L NO\_{2}$$

1. (5 points)Calculate the density of hydrogen bromide (HBr) gas in grams per liter at 733 mmHg and 46oC.

$$\frac{?g HBr}{L}=\frac{g HBr}{mol HBr}×\frac{mol HBr}{L HBr}=\frac{80.91 g HBr}{1 mol HBr}×\frac{3.68×10^{-2}mol HBr}{1 L}$$

$$=\frac{2.97 g HBr}{L}$$

 P = 733 torr

 T = 46oC = 319 K

 R = 62.4 L torr/mol K

$$PV=nRT \rightarrow \rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(733 torr\right)mol K}{\left(62.4 L torr\right)\left(319 K\right)}=\frac{3.68×10^{-2}mol HBr}{1 L}$$

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Quiz 6B (20 points) March 3, 2009

Data: PV=nRT R = 62.4 L torr/mol K = 0.0821 L atm/mol K

1. (5 points) A certain amount of gas at 25oC and at a pressure of 0.800 atm is contained in a glass vessel. Suppose that the vessel can withstand a pressure of 3.00 atm. How high can you raise the temperature of the gas without bursting the vessel?

P1 = 0.800 atm

P2 = 3.00 atm

T1= 25oC = 298 K

T2= ???

$$\frac{P\_{1}V\_{1}}{n\_{1}T\_{1}}=\frac{P\_{2}V\_{2}}{n\_{2}T\_{2}}\rightarrow \rightarrow \frac{P\_{1}}{T\_{1}}=\frac{P\_{2}}{T\_{2}}\rightarrow \rightarrow T\_{2}=T\_{1}\left(\frac{P\_{2}}{P\_{1}}\right)$$

$$T\_{2}=298 K\left(\frac{3.00 atm}{0.800 atm}\right)=1120 K or 844 ℃$$

1. (5 points) Ozone molecules in the stratosphere absorb much of the harmful radiation from the sun. Typically, the temperature and pressure of ozone in the stratosphere are 250 K and 1.0 x 10-2 atm, respectively. How many ozone molecules are present in 5.0 L of air under these conditions?

P = 1.0 x 10-2 atm

 T = 250 K

 V = 5.0 L

 R = 0.0821 L atm/mol K

 $PV=nRT \rightarrow \rightarrow n=\frac{PV}{RT}=\frac{\left(1.0×10^{-2}atm\right)\left(5.0 L\right)mol K}{\left(0.0821 L atm\right)\left(250 K\right)}$

$$=2.4×10^{-3}mol ozone$$

$$?molecules ozone=2.4×10^{-3}mol ozone×\frac{6.022 ×10^{23}molecules ozone}{1 mol ozone}$$

$$=1.5×10^{21}molecules ozone$$

1. (5 points) Consider the formation of nitrogen dioxide from nitric oxide and oxygen:

2 NO(g) + O2(g) 🡪 2 NO2(g)

If 6.0 L of NO are reacted with excess O2 at STP, what is the volume in liters of the NO2 produced?

$$?L NO\_{2}=6.0 L NO×\frac{1 L NO\_{2}}{1 L NO}=6.0 L NO\_{2}$$

1. (5 points)Calculate the density of hydrogen bromide (HBr) gas in grams per liter at 877 mmHg and 46oC.

$$\frac{?g HBr}{L}=\frac{g HBr}{mol HBr}×\frac{mol HBr}{L HBr}=\frac{80.91 g HBr}{1 mol HBr}×\frac{4.41×10^{-2}mol HBr}{1 L}$$

$$=\frac{3.56 g HBr}{L}$$

 P = 877 torr

 T = 46oC = 319 K

 R = 62.4 L torr/mol K

$$PV=nRT \rightarrow \rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(733 torr\right)mol K}{\left(62.4 L torr\right)\left(319 K\right)}=\frac{4.41×10^{-2}mol HBr}{1 L}$$

22.6 L/mol