Chemistry 141 Name Key

Dr. Cary Willard

Quiz 5A (20 points) October 8, 2012

Data: R = 0.0821 L atm/mol K = 62.4 L torr/mol K, 1 atm = 760 torr = 760 mm Hg, K = oC+273.16

1. (5 points) A 0.982 g sample of an unknown gas exerts a pressure of 700.0 mm Hg in a 450.0 mL container at 23oC. What is the molar mass of the gas?

$$PV=nRT \rightarrow n=\frac{PV}{RT}=\frac{\left(700.0 atm\right)\left(0.450 L\right) mol K}{\left(62.4 L torr\right)\left(296K\right)}=0.01705 mol$$

$$M=\frac{g gas}{mol gas}=\frac{0.982 g}{0.01705 mol}=\frac{57.6 g}{mol}$$

1. (5 points) Under constant pressure conditions a sample of hydrogen gas initially at 88oC and 9.6 L is cooled until its final volume is 3.4 L. What is its final temperature in oC?

$$PV=nRT\rightarrow R=\frac{PV}{RT}\rightarrow \frac{V\_{1}}{T\_{1}}=\frac{V\_{2}}{T\_{2}}$$

$$\rightarrow T\_{2}=T\_{1}\frac{V\_{2}}{V\_{1}}=\left(361 K\right)\left(\frac{3.4L}{9.6 L}\right)=129K or-145℃$$

1. (6 points) Oxygen masks use canisters containing potassium superoxide. The superoxide consumes the CO2 exhaled by a person and replaces it with oxygen.

4 KO2(s) + 2 CO2(g) ⎯→ 2 K2CO3(s) + 3 O2(g)

What mass of KO2, in grams is required to use up 8.90 L of CO2 at 22.0oC and 767 mmHg?

$$?mol CO\_{2}=n=\frac{PV}{RT}=\frac{\left(767 torr\right)\left(8.90 L\right)molK}{\left(62.4 L torr\right)\left(295K\right)}=0.371 mol$$

$$?g KO\_{2}=0.371 mol CO\_{2}×\frac{4 mol KO\_{2}}{2 mol CO\_{2}}×\frac{71.1 g KO\_{2}}{1 mol KO\_{2}}=52.8 g KO\_{2} $$

1. (4points) Why are gases so much more compressible than liquids and solids?

Because there is lots of empty space between the particles.

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Quiz 5B (20 points) October 8, 2012

Data: R = 0.0821 L atm/mol K = 62.4 L torr/mol K, 1 atm = 760 torr = 760 mm Hg, K = oC+273.16

1. (5 points) A 0.687 g sample of an unknown gas exerts a pressure of 700.0 mm Hg in a 450.0 mL container at 23oC. What is the molar mass of the gas?

$$PV=nRT \rightarrow n=\frac{PV}{RT}=\frac{\left(700.0 atm\right)\left(0.450 L\right) mol K}{\left(62.4 L torr\right)\left(296K\right)}=0.01705 mol$$

$$M=\frac{g gas}{mol gas}=\frac{0.687 g}{0.01705 mol}=\frac{40.3 g}{mol}$$

1. (5 points) Under constant pressure conditions a sample of hydrogen gas initially at 43oC and 9.6 L is cooled until its final volume is 3.4 L. What is its final temperature in oC?

$$PV=nRT\rightarrow R=\frac{PV}{RT}\rightarrow \frac{V\_{1}}{T\_{1}}=\frac{V\_{2}}{T\_{2}}$$

$$\rightarrow T\_{2}=T\_{1}\frac{V\_{2}}{V\_{1}}=\left(316 K\right)\left(\frac{3.4L}{9.6 L}\right)=112K or-161℃$$

1. (6 points) Oxygen masks use canisters containing potassium superoxide. The superoxide consumes the CO2 exhaled by a person and replaces it with oxygen.

4 KO2(s) + 2 CO2(g) ⎯→ 2 K2CO3(s) + 3 O2(g)

What mass of KO2, in grams is required to use up 12.8 L of CO2 at 22.0oC and 767 mmHg?

$$?mol CO\_{2}=n=\frac{PV}{RT}=\frac{\left(767 torr\right)\left(12.8 L\right)molK}{\left(62.4 L torr\right)\left(295K\right)}=0.533 mol$$

$$?g KO\_{2}=0.533 mol CO\_{2}×\frac{4 mol KO\_{2}}{2 mol CO\_{2}}×\frac{71.1 g KO\_{2}}{1 mol KO\_{2}}=75.8 g KO\_{2} $$

1. (4points) Why are gases so much more compressible than liquids and solids?

Because there is lots of empty space between the particles.