Chemistry 141 Name -

Dr. Cary Willard

Quiz 6A (20 points) March 10, 2011

1 atm = 101.3 kPa = 14.7 psi = 760 torr = 760 mm Hg, PV=nRT, R=0.0821 L atm/mol K=62.4 L torr/mol K

$\frac{rate\_{1}}{rate\_{2}}=\sqrt{\frac{MW\_{2}}{MW\_{1}}}$, $P\_{i}=P\_{total}X\_{i}$, $\left[P+a\left(\frac{n}{V}\right)^{2}\right]×\left[V-nb\right]=nRT$, $K=℃+273.16$

1. (5 points) A 1.30 g sample of dry ice (CO2) is added to a 755 mL flask containing nitrogen gas at a temperature of 25oC and a pressure of 725 torr. The dry ice is allowed to sublime (convert from solid to gas) and the mixture is allowed to return to 25.0oC. What is the total pressure in the flask?

$$P\_{CO\_{2}}=? torr$$

$$V=755 mL$$

$$n=1.30 g CO\_{2}×\frac{1 mol CO\_{2}}{44.01 g CO\_{2}}=0.0295 mol CO\_{2}$$

$$T=25℃+273=298 K$$

$$R={62.4 L torr}/{mol K}$$

$$PV=nRT $$

$$ P=\frac{nRT}{V}=\frac{\left(0.0295 mol CO\_{2}\right)\left(62.4 L torr\right)\left(298 K\right)}{\left(0.755 L\right) mol K}=728 torr CO\_{2}$$

$$P\_{total}=P\_{CO\_{2}}+P\_{N\_{2}}=728 torr+725 torr=1453 torr$$

1. (4 points) A sample of nitrogen gas is held in a 5.7 L container. If additional nitrogen is injected into the container, how will the pressure change if the temperature is held constant? Explain why this will occur using kinetic molecular theory.

The pressure will increase when more nitrogen is added because there will be more molecules of nitrogen hitting the walls of the container resulting in a higher pressure.

1. (5 points) A sample of argon effuses from a container in 53.2 seconds. If the same amount of an unknown gas requires 82.3 seconds to effuse, what is the molar mass of the unknown gas?

$$\frac{rate\_{Ar}}{rate\_{unknown}}=\sqrt{\frac{MW\_{unknown}}{MW\_{Ar}}}$$

$$\frac{\frac{x mol}{53.2 sec}}{\frac{x mol}{82.3 sec}}=\sqrt{\frac{MW\_{unknown}}{39.1 g/mol}}$$

$$\left(\frac{82.3 sec}{53.2 sec}=1.55=\sqrt{\frac{MW\_{unknown}}{39.95 g/mol}}\right)^{2}$$

$$\left(1.55\right)^{2}=2.39=\frac{MW\_{unknown}}{39.95 g/mol}$$

$$MW\_{unknown}=95.5 g/mol$$

1. (6 points) Mothballs are composed primarily of the hydrocarbon nahthaleine (C10H8). When 2.53 g of naphthalene is burned in a bomb calorimeter containing 500.0 g of water, the temperature rises from 23.7oC to 37.8oC. The heat capacity of the calorimeter is 5.15 kJ/K and the specific heat of water is 4.184 J/g K. Calculate the molar enthalpy of combustion for naphthalene.

$$Heat lost by reaction=heat gained by calorimeter+heat gained by water$$

$$Heat lost by reaction=\left(14.1 K\right)\left(\frac{5.15 kJ}{K}\right)\left(\frac{1000 J}{1 kJ}\right)+\left(500.0g\right)\left(\frac{4.184 J}{g K}\right)\left(14.1 K\right)$$

$$=72600 J+29500 J=102100 J$$

$$∆H\_{C\_{10}H\_{8}}=\frac{-102.1 kJ}{2.53 g C\_{10}H\_{8}}×\frac{128.2 g C\_{10}H\_{8}}{1 mol C\_{10}H\_{8}}=\frac{-5170 kJ}{mol C\_{10}H\_{8}}$$

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Quiz 6B (20 points) March 10, 2011

1 atm = 101.3 kPa = 14.7 psi = 760 torr = 760 mm Hg, PV=nRT, R=0.0821 L atm/mol K=62.4 L torr/mol K

$\frac{rate\_{1}}{rate\_{2}}=\sqrt{\frac{MW\_{2}}{MW\_{1}}}$, $P\_{i}=P\_{total}X\_{i}$, $\left[P+a\left(\frac{n}{V}\right)^{2}\right]×\left[V-nb\right]=nRT$, $K=℃+273.16$

1. (5 points) A 1.50 g sample of dry ice (CO2) is added to a 755 mL flask containing nitrogen gas at a temperature of 25oC and a pressure of 725 torr. The dry ice is allowed to sublime (convert from solid to gas) and the mixture is allowed to return to 25.0oC. What is the total pressure in the flask?

$$P\_{CO\_{2}}=? torr$$

$$V=755 mL$$

$$n=1.50 g CO\_{2}×\frac{1 mol CO\_{2}}{44.01 g CO\_{2}}=0.0341 mol CO\_{2}$$

$$T=25℃+273=298 K$$

$$R={62.4 L torr}/{mol K}$$

$$PV=nRT $$

$$ P=\frac{nRT}{V}=\frac{\left(0.0341 mol CO\_{2}\right)\left(62.4 L torr\right)\left(298 K\right)}{\left(0.755 L\right) mol K}=839 torr CO\_{2}$$

$$P\_{total}=P\_{CO\_{2}}+P\_{N\_{2}}=839 torr+725 torr=1564 torr$$

1. (4 points) A sample of nitrogen gas is held in a 5.7 L container. If additional nitrogen is injected into the container, how will the pressure change if the temperature is held constant? Explain why this will occur using kinetic molecular theory.

The pressure will increase when more nitrogen is added because there will be more molecules of nitrogen hitting the walls of the container resulting in a higher pressure.

1. (5 points) A sample of krypton effuses from a container in 53.2 seconds. If the same amount of an unknown gas requires 82.3 seconds to effuse, what is the molar mass of the unknown gas?

$$\frac{rate\_{Kr}}{rate\_{unknown}}=\sqrt{\frac{MW\_{unknown}}{MW\_{Kr}}}$$

$$\frac{\frac{x mol}{53.2 sec}}{\frac{x mol}{82.3 sec}}=\sqrt{\frac{MW\_{unknown}}{83.8 g/mol}}$$

$$\left(\frac{82.3 sec}{53.2 sec}=1.55=\sqrt{\frac{MW\_{unknown}}{83.8 g/mol}}\right)^{2}$$

$$\left(1.55\right)^{2}=2.39=\frac{MW\_{unknown}}{83.8 g/mol}$$

$$MW\_{unknown}=200. g/mol$$

1. (6 points) Mothballs are composed primarily of the hydrocarbon nahthaleine (C10H8). When 2.89 g of naphthalene is burned in a bomb calorimeter containing 500.0 g of water, the temperature rises from 23.7oC to 39.8oC. The heat capacity of the calorimeter is 5.15 kJ/K and the specific heat of water is 4.184 J/g K. Calculate the molar enthalpy of combustion for naphthalene.

$$Heat lost by reaction=heat gained by calorimeter+heat gained by water$$

$$Heat lost by reaction=\left(16.1 K\right)\left(\frac{5.15 kJ}{K}\right)\left(\frac{1000 J}{1 kJ}\right)+\left(500.0g\right)\left(\frac{4.184 J}{g K}\right)\left(16.1 K\right)$$

$$=82900 J+33700 J=116600 J$$

$$∆H\_{C\_{10}H\_{8}}=\frac{116.6 kJ}{2.89 g C\_{10}H\_{8}}×\frac{128.2 g C\_{10}H\_{8}}{1 mol C\_{10}H\_{8}}=\frac{5170 kJ}{mol C\_{10}H\_{8}}$$