Chemistry 141 Name

Dr. Cary Willard

Quiz 5A (20 points) March 13, 2013

Data: PV = nRT, R = 0.0821 L atm/mol K = 62.4 L torr/mol K, K=oC + 273.16, $\frac{rate 1}{rate 2}=\sqrt{\frac{M\_{2}}{M\_{1}}}$

1. (5 points) An experiment shows that a 364 mL gas sample has a mass of 0.747 g at a pressure of 0.644 atm and a temperature of 37oC. What is the molar mass of the gas?

$$PV=nRT \rightarrow \rightarrow \frac{V}{n}=\frac{RT}{P}=\frac{\left(0.0821 L atm\right)\left(310 K\right)}{mol K \left(0.644 atm\right)}=\frac{39.5 L}{mol}$$

$$M=\frac{0.747 g}{0.364 L}×\frac{39.5 L}{mol}=81.1 g/mol$$

1. (5 points) A 485 mL flask contains pure neon at a pressure of 539 torr. A second flask with a volume of 395 mL contains pure xenon at a pressure of 627 torr. If the two flasks are connected through a stopcock and the stopcock is opened, what are the partial pressures of each gas and the total pressure?

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

|  |  |
| --- | --- |
| Neon | Xenon |
| P1 = 539 torrV1 = 485 mLV2 = 485 mL + 395 mL = 880 mL | P1 = 627 torrV1 = 395 mLV2 = 485 mL + 395 mL = 880 mL |
| $$P\_{2}=P\_{1}\left(\frac{V\_{1}}{V\_{2}}\right)=\left(539 torr\right)\left(\frac{485 mL}{880 mL}\right)=297 torr$$ | $$P\_{2}=P\_{1}\left(\frac{V\_{1}}{V\_{2}}\right)=\left(627 torr\right)\left(\frac{395 mL}{880 mL}\right)=281 torr$$ |

Total pressure = 297 torr + 281 torr = 578 torr

1. (5 points) A sample of CO2 effuses from a container in 67 seconds. How long would it take the same amount of butane gas (C4H10) to effuse from the same container under identical conditions?

$$\frac{rate CO\_{2}}{rate C\_{4}H\_{10}}=\sqrt{\frac{M\_{C\_{4}H\_{10}}}{M\_{CO\_{2}}}} \rightarrow \rightarrow \frac{\frac{x molecules}{67 sec}}{\frac{x molecules}{?sec}}=\sqrt{\frac{58.12 g/mol}{44.01 g/mol}=1.15}$$

$$\frac{?sec}{67 sec}=1.15 \rightarrow ?\sec(=77 sec)$$

1. (5 points) Which postulate of kinetic molecular theory breaks down under conditions of low temperature? Explain.

KMT says that molecules have no attractions or repulsions. At low temperatures these interactions begin to become important and impact gas behavior.

Chemistry 141 Name

Dr. Cary Willard

Quiz 5B (20 points) March 13, 2013

Data: PV = nRT, R = 0.0821 L atm/mol K = 62.4 L torr/mol K, K=oC + 273.16, $\frac{rate 1}{rate 2}=\sqrt{\frac{M\_{2}}{M\_{1}}}$

1. (5 points) An experiment shows that a 277 mL gas sample has a mass of 0.615 g at a pressure of 0.504 atm and a temperature of 37oC. What is the molar mass of the gas?

$$PV=nRT \rightarrow \rightarrow \frac{V}{n}=\frac{RT}{P}=\frac{\left(0.0821 L atm\right)\left(310 K\right)}{mol K \left(0.504 atm\right)}=\frac{50.5 L}{mol}$$

$$M=\frac{0.615 g}{0.277 L}×\frac{50.5 L}{mol}=112 g/mol$$

1. (5 points) A 485 mL flask contains pure neon at a pressure of 486 torr. A second flask with a volume of 395 mL contains pure xenon at a pressure of 731 torr. If the two flasks are connected through a stopcock and the stopcock is opened, what are the partial pressures of each gas and the total pressure?

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

|  |  |
| --- | --- |
| Neon | Xenon |
| P1 = 486 torrV1 = 485 mLV2 = 485 mL + 395 mL = 880 mL | P1 = 731 torrV1 = 395 mLV2 = 485 mL + 395 mL = 880 mL |
| $$P\_{2}=P\_{1}\left(\frac{V\_{1}}{V\_{2}}\right)=\left(486 torr\right)\left(\frac{485 mL}{880 mL}\right)=267 torr$$ | $$P\_{2}=P\_{1}\left(\frac{V\_{1}}{V\_{2}}\right)=\left(731 torr\right)\left(\frac{395 mL}{880 mL}\right)=328 torr$$ |

Total pressure = 267 torr + 328 torr = 595 torr

1. (5 points) A sample of CO2 effuses from a container in 82 seconds. How long would it take the same amount of butane gas (C4H10) to effuse from the same container under identical conditions?

$$\frac{rate CO\_{2}}{rate C\_{4}H\_{10}}=\sqrt{\frac{M\_{C\_{4}H\_{10}}}{M\_{CO\_{2}}}} \rightarrow \rightarrow \frac{\frac{x molecules}{82 sec}}{\frac{x molecules}{?sec}}=\sqrt{\frac{58.12 g/mol}{44.01 g/mol}=1.15}$$

$$\frac{?sec}{82 sec}=1.15 \rightarrow ?\sec(=94 sec)$$

1. (5 points) Which postulate of kinetic molecular theory breaks down under conditions of low temperature? Explain.

KMT says that molecules have no attractions or repulsions. At low temperatures these interactions begin to become important and impact gas behavior.