Chemistry 141 Name

Cary Willard

Quiz 4a (20 points) October 1, 2009

All work must be show to receive credit. Remember, significant figures are important!

PV=nRT, R=62.4 L torr/mol K = 0.0821 L atm/mol K, $\frac{rate\_{1}}{rate\_{2}}=\sqrt{\frac{molar mass\_{2}}{molar mass\_{1}}}$

1. (6 points) You have a sample of CO2 in a flask A with a volume of 25.0 mL. At 20.5oC, the pressure of the gas is 436.5 mm Hg. To find the volume of another flask, B, you move the CO2 to that flask and find that its pressure is not 94.3 mm Hg at 24.5 oC. What is the volume of flask B?

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

|  |  |
| --- | --- |
| Flask A | Flask B |
| P1 = 436.5 mm Hg | P2 = 94.3 mm Hg |
| V1 = 25.0 mL | V2 = ?? |
| T1 = 20.5oC + 273.16 = 293.7 K | T2 = 24.5oC + 273.16 = 297.7 K |
| n1 = n2 |  |

$$V\_{2}=V\_{1}\left(\frac{P\_{1}}{P\_{2}}\right)\left(\frac{T\_{2}}{T\_{1}}\right)=25.0 mL\left(\frac{436.5 mm Hg}{94.3 mm Hg}\right)\left(\frac{297.7 K}{293.7 K}\right)=117 mL$$

1. (6 points) Diethyl ether, (C2H5)2O, vaporizes easily at room temperature. If the vapor exerts a pressure of 233 mm Hg in a flask at 25oC, what is the density of the vapor? (Remember to use your units to help you solve this problem!)

$$density=\frac{g ether}{L ether}=\frac{74.12 g ether}{1 mol ether}×\frac{0.0125 mol ether}{1 L ether}=\frac{0.926 g ether}{L ether}$$

$$PV=nRT \rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(233 torr\right)mol K}{\left(62.4 L torr\right)\left(298 K\right)}=\frac{0.0125}{L ether}$$

1. (6 points) Phosgene (COCl2), a potent neurotoxin can be composed using the reaction below.

CO(g) + Cl2(g) 🡪 COCl2(g)

If a flask containing carbon monoxide and chlorine gas at a total pressure of 5.46 atm undergoes reaction to form phosgene and the final pressure of the system is 3.88 atm, what is the final partial pressure of phosgene?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | CO(g) | + | Cl2(g)  | 🡪 | COCl2(g) | Total pressure |
| I | ?? |  | ?? |  |  | 5.46 atm |
|  | -x  |  | -x |  | +x | -1.58 |
| E | ?? -x |  | ?? -x |  | X =  | 3.88 atm |

Final pressure of COCl2 is 1.58

1. (2 points) If a large balloon is filled with neon and argon gas, which gas should effuse out of the balloon faster? Explain your reasoning.

The neon will effuse faster because it has a lower molar mass

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All work must be show to receive credit. Remember, significant figures are important!

PV=nRT, R=62.4 L torr/mol K = 0.0821 L atm/mol K, $\frac{rate\_{1}}{rate\_{2}}=\sqrt{\frac{molar mass\_{2}}{molar mass\_{1}}}$

1. (6 points) You have a sample of CO2 in a flask A with a volume of 25.0 mL. At 20.5oC, the pressure of the gas is 632.5 mm Hg. To find the volume of another flask, B, you move the CO2 to that flask and find that its pressure is 125.3 mm Hg at 24.5 oC. What is the volume of flask B?

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

|  |  |
| --- | --- |
| Flask A | Flask B |
| P1 = 436.5 mm Hg | P2 = 125.3 mm Hg |
| V1 = 25.0 mL | V2 = ?? |
| T1 = 20.5oC + 273.16 = 293.7 K | T2 = 24.5oC + 273.16 = 297.7 K |
| n1 = n2 |  |

$$V\_{2}=V\_{1}\left(\frac{P\_{1}}{P\_{2}}\right)\left(\frac{T\_{2}}{T\_{1}}\right)=25.0 mL\left(\frac{436.5 mm Hg}{125.3 mm Hg}\right)\left(\frac{297.7 K}{293.7 K}\right)=88.3 mL$$

1. (6 points) Diethyl ether, (C2H5)2O, vaporizes easily at room temperature. If the vapor exerts a pressure of 365 mm Hg in a flask at 25oC, what is the density of the vapor? (Remember to use your units to help you solve this problem!)

$$density=\frac{g ether}{L ether}=\frac{74.12 g ether}{1 mol ether}×\frac{0.0191 mol ether}{1 L ether}=\frac{1.41 g ether}{L ether}$$

$$PV=nRT \rightarrow \frac{n}{V}=\frac{P}{RT}=\frac{\left(365 torr\right)mol K}{\left(62.4 L torr\right)\left(298 K\right)}=\frac{0.0191 mol ether}{L ether}$$

1. (6 points) Phosgene (COCl2), a potent neurotoxin can be composed using the reaction below.

CO(g) + Cl2(g) 🡪 COCl2(g)

If a flask containing carbon monoxide and chlorine gas at a total pressure of 6.23 atm undergoes reaction to form phosgene and the final pressure of the system is 4.66 atm, what is the final partial pressure of phosgene?

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | CO(g) | + | Cl2(g)  | 🡪 | COCl2(g) | Total pressure |
| I | ?? |  | ?? |  |  | 6.23 atm |
|  | -x  |  | -x |  | +x | -1.57 |
| E | ?? -x |  | ?? -x |  | X =  | 4.66 atm |

Final pressure of COCl2 is 1.57 mol

1. (2 points) If a large balloon is filled with neon and argon gas, which gas should effuse out of the balloon faster? Explain your reasoning

The neon will effuse faster because it has a lower molar mass