Chemistry 141 Name key

Dr. Cary Willard

Quiz 4a February 25, 2010

PV=nRT, R=0.0821 L atm/mol K = 62.4 L torr/mol K, 1 atm = 760 torr

1. (5 points) A bacterial culture isolated from sewage produced 35.5 mL of methane, CH4, at 31oC and 753 mm Hg. What is the volume of this methane at standard temperature and pressure (0oC and 760 mm Hg)?

$\frac{P\_{1}V\_{1}}{T\_{1}}=\frac{P\_{2}V\_{2}}{T\_{2}}$

|  |  |  |
| --- | --- | --- |
|  | initial | final |
| P | 753 torr | 760 torr |
| V | 35.5 mL | ? |
| n | constant | Constant |
| T | 31oC=304K | 0oC=273K |

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

$$=35.5 mL\left(\frac{753 torr}{760 torr}\right)\left(\frac{273 K}{304 K}\right)=31.6 mL$$

1. (5 points) According to your calculations, a reaction should yield 5.67 g of oxygen gas, O2. What do you expect the volume to be at 23oC and 0.985 atm?

$5.67 g O\_{2}×\frac{1 mol O\_{2}}{32 g O\_{2} }=0.177 mol O\_{2}$

|  |  |
| --- | --- |
| P | 0.985 atm |
| V | ? |
| n | 0.177 mol |
| T | 23oC=296 K |

$$PV=nRT$$

$$V=\frac{nRT}{P}=\frac{\left(0.177 mol\right)\left(0.0821 L atm\right)\left(296 K\right)}{mol K\left(0.985 atm\right)}=4.37 L O\_{2} $$

1. (5 points) You vaporize a liquid substance at 100oC and 755 mm Hg. The volume of 0.548 g of vapor is 237 mL. What is th molecular mass of the substance?

$$molar mass=\frac{g vapor}{mol}=\frac{0.548 g vapor}{0.237 L }×\frac{1 L}{0.0324 mol}=\frac{71.4 g vapor}{mol}$$

$$PV=nRT$$

$$\frac{n}{V}=\frac{P}{RT}=\frac{\left(755 torr\right)mol K}{\left(62.4 L torr\right)\left(373 K\right)}=\frac{0.0324 mol}{L} \left(\frac{30.8 L}{mol}\right)$$

1. (5 points) Oxygen gas is converted to ozone gas under certain conditions. If oxygen gas is introduced into a50.0 mL flask with a pressure of 497 torr and 529 K and allowed to react, the final pressure in the flask is 447 torr. How many moles of ozone have been formed in the reaction?

3O2(g) 🡪 2 O3(g)

$PV=nRT$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 3O2(g) | 🡪 | 2 O3(g) | pressure |
| I | 497 torr |  | 0 torr | 497 torr |
| D | –3x |  | +2x | – 50 torr |
| E | 497–3x |  | 2x | 447 torr |
|  |  |  | =100 torr |  |

$$n=\frac{PV}{RT}$$

$$=\frac{\left(100 torr\right)\left(0.0500 L\right)mol K}{\left(62.4 L torr\right)\left(529 K\right)}$$

$$=1.51×10^{-4}mol O\_{3}$$

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Quiz 4b February 25, 2010

PV=nRT, R=0.0821 L atm/mol K = 62.4 L torr/mol K, 1 atm = 760 torr

1. (5 points) A bacterial culture isolated from sewage produced 53.5 mL of methane, CH4, at 31oC and 753 mm Hg. What is the volume of this methane at standard temperature and pressure (0oC and 760 mm Hg)?

 $\frac{P\_{1}V\_{1}}{T\_{1}}=\frac{P\_{2}V\_{2}}{T\_{2}}$

|  |  |  |
| --- | --- | --- |
|  | initial | final |
| P | 753 torr | 760 torr |
| V | 53.5 mL | ? |
| n | constant | Constant |
| T | 31oC=304K | 0oC=273K |

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

$$=53.5 mL\left(\frac{753 torr}{760 torr}\right)\left(\frac{273 K}{304 K}\right)=47.6 mL$$

1. (5 points) According to your calculations, a reaction should yield 3.87 g of oxygen gas, O2. What do you expect the volume to be at 23oC and 0.985 atm?

3.87$ g O\_{2}×\frac{1 mol O\_{2}}{32 g O\_{2} }=0.121 mol O\_{2}$

|  |  |
| --- | --- |
| P | 0.985 atm |
| V | ? |
| n | 0.121 mol |
| T | 23oC=296 K |

$$PV=nRT$$

$$V=\frac{nRT}{P}=\frac{\left(0.121 mol\right)\left(0.0821 L atm\right)\left(296 K\right)}{mol K\left(0.985 atm\right)}=2.98 L O\_{2} $$

1. (5 points) You vaporize a liquid substance at 100oC and 755 mm Hg. The volume of 0.548 g of vapor is 278 mL. What is th molecular mass of the substance?

$$molar mass=\frac{g vapor}{mol}=\frac{0.548 g vapor}{0.278 L }×\frac{1 L}{0.0324 mol}=\frac{60.8 g vapor}{mol}$$

$$PV=nRT$$

$$\frac{n}{V}=\frac{P}{RT}=\frac{\left(755 torr\right)mol K}{\left(62.4 L torr\right)\left(373 K\right)}=\frac{0.0324 mol}{L} \left(\frac{30.8 L}{mol}\right)$$

1. (5 points) Oxygen gas is converted to ozone gas under certain conditions. If oxygen gas is introduced into a50.0 mL flask with a pressure of 541 torr and 529 K and allowed to react, the final pressure in the flask is 487 torr. How many moles of ozone have been formed in the reaction?

3O2(g) 🡪 2 O3(g)

$PV=nRT$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 3O2(g) | 🡪 | 2 O3(g) | pressure |
| I | 497 torr |  | 0 torr | 541 torr |
| D | –3x |  | +2x | – 54 torr |
| E | 497–3x |  | 2x | 487 torr |
|  |  |  | =108 torr |  |

$$n=\frac{PV}{RT}$$

$$=\frac{\left(108 torr\right)\left(0.0500 L\right)mol K}{\left(62.4 L torr\right)\left(529 K\right)}$$

$$=1.63×10^{-4}mol O\_{3}$$