NAME: **HONORS CHEMISTRY**

SECTION: Dalton’s Law of Partial Pressures

Dalton’s Law of Partial Pressures states that the sum of the individual pressures of all the gases that make up a mixture is equal to the total pressure exerted by the mixture.

 $P\_{tot}=P\_{1}+P\_{2}+P\_{3}…$

Clues that a problem involves Dalton’s Law of Partial Pressures:

* The gas is collected by water displacement
* The gas is collected over water
* The question asks about the dry gas
* The question gives you the vapor pressure of water

**Level 1 Problems**

For problems 1-3, use the data in Table 1.

Show all your work!

1. A gas is collected by water displacement at 45oC at a total pressure of 113.45 kPa. What is the partial pressure exerted by the gas?

Table 1. Vapor pressure of water

at various temperatures

|  |  |
| --- | --- |
| Temperature (oC) | H2O Pressure (kPa) |
| 0 | 0.61 |
| 5 | 0.87 |
| 10 | 1.25 |
| 15 | 1.71 |
| 20 | 2.34 |
| 25 | 3.17 |
| 30 | 4.25 |
| 35 | 5.63 |
| 40 | 7.38 |
| 45 | 9.59 |
| 50 | 12.34 |
| 55 | 15.75 |

1. A gas is collected over water at a temperature of 25oC. The total pressure is 97.18 kPa. Determine the partial pressure exerted by the gas.
2. The air pressure over a pond at 15oC is 101.75 kPa. What is the partial pressure of the dry air?
3. A 250. mL sample of oxygen is collected over water at 25oC and 760.0 torr pressure. What is the pressure of the dry oxygen alone? The vapor pressure of water at 25oC is 23.8 torr.

The mole fraction is defined as the moles of substance A divided by total moles. It is always expressed in decimal form.

$$mole fraction= \frac{moles A}{total moles}$$

Therefore, the partial pressure exerted by an individual gas is equal to the mole fraction of the gas times the total pressure.

$$P\_{A}= \frac{moles A}{total moles}×P\_{tot}$$

**Level 2 Problems**

1. A mixture of 3.00 moles of Ar, 4.50 moles of H2O, 1.75 moles of N2, and 6.00 moles of CO2 exerts a total pressure of 900. torr. What is the partial pressure exerted by each gas?
2. The partial pressure of Cl2 is 400. torr in a mixture of gases where the total pressure is 2.00 atm. What is the mole fraction of Cl2?

**Level 3 Problems**

1. A 45.0 mL sample of hydrogen is collected over water at 23oC and 775.0 torr pressure. What is the volume of the dry gas at STP? (The vapor pressure of water at 23oC is 21.1 torr)
2. A 78.3 mL sample of a gas is collected over water at 20. oC and 735.8 torr pressure. What is the volume of the dry gas at STP? (The vapor pressure of water at 20. oC is 17.5 torr)