Dalton's Law Practice Problems

1) Three flasks are connected to each other, separated only by a three-way stopcock.
   - Flask 1 has a volume of 3.000 liters and holds helium gas at a pressure of 3.500 atmospheres
   - Flask 2 has a volume of 2.000 liters and holds nitrogen gas at a pressure of 2.000 atmospheres
   - Flask 3 has a volume of 1.800 liters and holds oxygen gas at a pressure of 4.000 atmospheres

   If the stopcock separating the flasks were to be opened, what would the partial pressure of each gas in the apparatus be?

2) What would the total pressure in the apparatus be?

3) What would the mole fraction of oxygen be inside the apparatus after the stopcock was opened?

4) If liquid water is added to the mixture, what will the mole fraction of each of the gases in the mixture be? The vapor pressure of water at 25^0 C is 0.031 atm.

Dalton's Law Practice Problems Solutions

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- Flask 1 has a volume of 3.000 liters and holds helium gas at a pressure of 3.500 atmospheres
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If the stopcock separating the flasks were to be opened, what would the partial pressure of each gas in the apparatus be?

Use the combined gas law to treat each gas as if it were expanding from its flask into a vacuum.

P_{He} = 1.54 atmospheres
P_{N2} = 0.74 atmospheres
P_{O2} = 1.06 atmospheres

2) What would the total pressure in the apparatus be?

Dalton's Law states that the total pressure will be equal to the sum of the partial pressures, so the final pressure will be 1.54 + 0.74 + 1.06 = 3.34 atm.

3) What would the mole fraction of oxygen be inside the apparatus after the stopcock was opened?

Mole fraction is equal to the partial pressure of a gas divided by the total pressure of a system. In this case, the mole fraction of oxygen is 0.32

4) If liquid water is added to the mixture, what will the mole fraction of each of the gases in the mixture be? The vapor pressure of water at 25^0 C is 0.031 atm.

To solve, use Dalton's Law to determine what the pressure of the mixture will be (it's the same as the answer from #2, with the additional pressure of water added, or 3.37 atmospheres).

In the second step, divide the partial pressure of each gas by the total pressure to find that:
x_{He} = 0.46 x_{N2} = 0.22 x_{O2} = 0.31 x_{H2O} = 0.01