Answer on Question #53911 – Chemistry – General chemistry

Question:

472 mL of H_2 was collected over water when 1.256 g Zn reacted with excess HCl. The atmospheric pressure during the experiment was 754 mm Hg and the temperature was 26 degree Celsius.
A.) Write the balanced chemical equation for this reaction.
B.) What is the water vapor pressure at 26 degree Celsius to mm Hg?
C.) What is the partial pressure (in atmosphere) of dry hydrogen gas in the mixture?
D.) Calculate the number of moles of H_2 produced by this reaction using the ideal gas law.

Answer:

A) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
B) The water vapor pressure at 26 degree Celsius can be found:
   P(mm Hg) = exp(20.386 – 5132/T)
   If T = 26 +273 K = 299 K, then P = exp(20.386 – 5132/299) = 25.081 mm Hg
C) The partial pressure of hydrogen equals:
   $p(H_2)$ = P(Total) - $p(H_2O)$, where P(Total) – the total pressure which is of 754 mm Hg and $p(H_2O)$
   – the partial pressure of water.
   $p(H_2)$ = 754 mm Hg -25.081 mm Hg = 728.919 mm Hg = 0.959104 atm
D) The number of moles of H_2 can be found:
   $\mu = (pV)/(RT)$,
   where p – the partial pressure of hydrogen which is of 0.959104 atm, V – the volume of hydrogen which equals 472 mL, R- the gas constant which is of 0.082057 L atm K^{-1} mol^{-1}, T – the temperature that is of 299 K.
   Thus,
   μ = (0.472 L × 0.959104 atm) / (0.082057 L atm K^{-1} mol^{-1} ×299 K) = 0.02 moles