Task:

calculate the mass of 400 mL of CO2 collected over water at 30 degrees celcius and 749 mm Hg, The vapor pressure of water at 30 degrees Celsius is 31.8 mm Hg

Solution:

The Ideal gas Law allows to calculate the amount of CO_2.

The Ideal Gas Law:

$P \cdot V = n \cdot R \cdot T$

P - pressure (atm)

V – volume (L)

n – the number of moles

R – the universal gas constant (0.082 atm · L / (mol · K))

T – Kelvin temperature

We have to convert mm Hg to atm

1 atm = 760 mm Hg

The conversion factor is

f = 1 / 760

P (atm) = 749 · 1/760 = 0.986 atm

We also have to convert temperature in degrees Celsius to Kelvins

T(K) = T(°C) + 273

T(K) = 30 + 273 = 303 K

The number of moles of CO_2 is

$n(CO_2) = P \cdot V / (R \cdot T) = 0.986 \cdot 0.400 / (0.082 \cdot 303) = 0.016$ mol

The mass of CO_2 is

$m(g) = n(mol) \cdot MW(CO_2)$

$MW(CO_2) = MW(C) + 2 \cdot MW(O) = 12 + 2 \cdot 16 = 44$ g/mol

$m(CO_2) = 0.016 \cdot 44 = 0.704$ g

Answer: m (CO_2)) = 0.704 g