

Question #63034, Chemistry / Physical Chemistry

A mixture of CO and CO₂ is found to have density of 1.7g/lit at 1atm and 273k. The mole fraction of CO is.

Solution:

According to Mendeleev-Clapeiron equation:

$$pV = nRT = \frac{m}{M_r} RT$$
$$d = \frac{m}{V} = \frac{pM_r}{RT}$$
$$M_r = \frac{dRT}{p}$$

Suppose, mole fraction of CO is x . Then mole fraction of CO₂ is $1-x$.

$$M_r(mx) = xM_r(CO) + (1-x)M_r(CO_2) = 28.01x + 44.01(1-x) = 72.02x - 44.01$$

$$72.02x - 44.01 = \frac{1700 \frac{g}{m^3} \times 8.31 \frac{J}{K \times mol} \times 273 K}{101325 Pa}$$

$$72.02x - 44.01 = 38.06$$

$$72.02x = 38.06 + 44.01$$

$$72.02x = 82.07$$

$$x = \frac{82.07}{72.02} = 1.14$$

Answer:

The mole fraction of CO is 0.88.

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