Partial Pressure

① $n_{He} = \frac{15.2\ g}{4\ g/mol} = 3.8\ mol\ He$

$P_{He} = \frac{nRT}{V} = \frac{(3.8)(0.08206)(295)}{(5)} = 18.4\ atm$

$n_{O_2} = \frac{30.6\ g}{32\ g/mol} = 0.96\ mol\ O_2$

$P_{O_2} = \frac{nRT}{V} = \frac{(0.96)(0.08206)(295)}{(5)} = 4.6\ atm$

$P_{Total} = P_{He} + P_{O_2} = 18.4 + 4.6 = 23\ atm$

② $n_{H_2} = \frac{1\ g}{2.02\ g/mol} = 0.495\ mol\ H_2$

$P_{H_2} = \frac{nRT}{V} = \frac{(0.495)(0.08206)(300)}{(1)} = 12.2\ atm$

$n_{He} = \frac{1\ g}{4\ g/mol} = 0.25\ mol\ He$

$P_{He} = \frac{nRT}{V} = \frac{(0.25)(0.08206)(300)}{(1)} = 6.2\ atm$

$P_{total} = P_{H_2} + P_{He} = 12.2 + 6.2 = 18.4\ atm$

③

$n_{N_2} = 5 \times 10^{-2}$ mol N_2

$P_{N_2} = \frac{nRT}{V} = \frac{(5 \times 10^{-2})(0.08206)(273)}{(1)} = 1.12$ atm

$n_{O_2} = 1.5 \times 10^{2}$ mg $\times \frac{1\ g}{1000\ mg} \times \frac{1\ mol}{32\ g} = 0.0047$ mol O_2

$P_{O_2} = \frac{nRT}{V} = \frac{(0.0047)(0.08206)(273)}{(1)} = 0.105$ atm

$n_{NH_3} = 5 \times 10^{21}$ molecules $\times \frac{1\ mol}{6.02 \times 10^{23}} = 0.0083$ mol NH_3

$P_{NH_3} = \frac{nRT}{V} = \frac{(0.0083)(0.08206)(273)}{(1)} = 0.19$ atm

$P_{total} = 1.12 + 0.105 + 0.19 = 1.415$ atm

④

$$X_1 = \frac{P_1}{P_{total}} = \frac{170 \text{ torr}}{745 \text{ torr}} = 0.23 \quad \text{cyclopropane}$$

⑤ $P_{total} = 0.175 + 0.250 = 0.425 \text{ atm}$

a) $$X_{CH_4} = \frac{0.175}{0.425} = 0.41$$

$$X_{O_2} = \frac{0.250}{0.425} = 0.59$$

b) $$n_{total} = \frac{P_{total} V}{RT}$$

$$= \frac{(0.425)(10.5)}{(0.08206)(338)}$$

$$n_{total} = 0.161 \text{ mol}$$

c) $$X_{CH_4} = \frac{n_{CH_4}}{n_{total}}$$

$$n_{CH_4} = X_{CH_4} \cdot n_{total}$$

$$= (0.41)(0.161)$$

$$= 0.066 \text{ mol}$$

$$0.066 \text{ mol } CH_4 \times \frac{16.04 \text{ g}}{\text{mol}} = 1.06 \text{ g } CH_4$$

⑤ c) $n_{O_2} = X_{O_2} \cdot n_{total}$

$= (0.59)(0.161)$

$= 0.095 \text{ mol } O_2$

$0.095 \text{ mol } O_2 \times \frac{32 \text{ g}}{\text{mol}} = 3.04 \text{ g } O_2$