Answer on Question #48364-Physics-Molecular Physics-Thermodynamics

If α (alpha) moles of a monoatomic gas are mixed with β (beta) moles of a polyatomic gas and mixture behaves like diatomic gas, then [neglect the vibrational mode of freedom]

Solution

Energy associated with α moles of a monoatomic gas is

$$U_1 = \alpha \frac{3}{2} RT.$$

Energy associated with β moles of a polyatomic gas is

$$U_2 = \beta \frac{n}{2} RT.$$

Energy associated with $(\alpha + \beta)$ moles of a diatomic gas is

$$U_3 = (\alpha + \beta) \frac{5}{2} RT.$$

Then

$$U_1 + U_2 = U_3 \rightarrow \alpha \frac{3}{2} RT + \beta \frac{n}{2} RT = (\alpha + \beta) \frac{5}{2} RT.$$

$$n = \frac{5(\alpha + \beta) - 3\alpha}{\beta} = \frac{5\beta + 2\alpha}{\beta} = 5 + 2 \frac{\alpha}{\beta}.$$

Answer: $5 + 2 \frac{\alpha}{\beta}.$