Previous year JEE questions 6

A 4 : 1 molar mixture of He and CH_4 is contained in a vessel at 20 bar pressure . Due to a hole in the vessel, the gas mixture leaks out. What is the composition of the mixture effusing out initially? *(1994 - 2 Marks)*

TIPS/Formulae :

Partial pressure = Mole fraction × Total pressure

$$\therefore p_{He} = x_{He} \times P = \frac{4}{5} \times 20 = 16 \text{ bar}$$

$$\left[\text{mole fraction of He} = \frac{4}{5} \right]$$

$$\therefore p_{CH_4} = 20 - 16 = 4 \text{ bar}$$

Now applying the formula

$$\frac{r_{He}}{r_{CH_4}} = \frac{p^0_{He}}{p^0_{CH_4}} \sqrt{\frac{M_{CH_4}}{M_{He}}} = \frac{16}{4}\sqrt{\frac{16}{4}} = \frac{16}{4}\sqrt{4}$$

$$\therefore \quad r_{He} : r_{CH_3} = 8 : 1$$

$\therefore$ Composition of the mixture (He : CH_4) effusing out = **8 : 1**