Task:

Compute the relative rate of diffusion of phosphine (PH_3) to methane (CH_4)

Answer:

To solve this task a Graham's law must be applied.

$$Rate_{diffusion} \propto \frac{1}{\sqrt{MM}}$$

According to it:

$$\frac{Rate(PH_3)^2}{M(PH_3)} = \frac{Rate(CH_4)^2}{M(CH_4)}$$

$$M(PH_3) = 34 g/mol$$

$$M(CH_4) = 16 g/mol$$

$$Rate\ ratio = \sqrt{\frac{M(CH_4)}{M(PH_3)}} = \sqrt{\frac{16}{34}} = 0.686$$