

Problem: HBr has a molecular weight of 81 while CH<sub>4</sub> has a molecular weight of 16. HBr effuses through a opening at 4 ml/sec. at what rate will the CH<sub>4</sub> effuse through the same opening.

The speed of effusion of gases is inversely proportional to the square root of their molecular weight.

$$\frac{\text{rate}_A}{\text{rate}_B} = \frac{\sqrt[2]{M_B}}{\sqrt[2]{M_A}}$$

In this case rate<sub>A</sub> is HBr and rate<sub>B</sub> is CH<sub>4</sub>. Therefore to find rate<sub>CH<sub>4</sub></sub>, we will find rate<sub>B</sub>. We know the following information from the problem.

$$\text{rate}_A := 4$$

$$M_A := 81$$

$$M_B := 16$$

Therefore,

$$\text{nonlinsolve} \left( \frac{\text{rate}_A}{\text{rate}_B} = \frac{\sqrt[2]{M_B}}{\sqrt[2]{M_A}}, \text{rate}_B \right) = 9$$

And the rate of effusion is 9 ml/sec.