

In-class problem linked to lecture pages 232-240

Find an expression for the most probable speed of a molecule in a gas.

In-class 232-240

$$P(v) = 4\pi \left(\frac{\beta m}{2\pi} \right)^{3/2} e^{-\frac{\beta m v^2}{2}} v^2$$

$$0 = \frac{dP(v)}{dv} = 4\pi \left(\frac{\beta m}{2\pi} \right)^{3/2} \left[e^{-\frac{\beta m v^2}{2}} \cdot 2v + v^2 \cdot \left(-\frac{\beta m \cdot 2v}{2} \right) e^{-\frac{\beta m v^2}{2}} \right]$$

$$0 = 2v - \beta m v^3$$

$$0 = 2 - \beta m v^2$$

$$v = \sqrt{\frac{2}{\beta m}} = \sqrt{\frac{2kT}{m}}$$