Quiz 7.3 – Gas Kinetics

Name: Key

Problem 1 (2 points)

The temperature in Cedar city can range over the year from $-10\ ^\circ C$ and $35\ ^\circ C$ → 308 K

Find the v_{rms} for nitrogen gas at $-10\ ^\circ C$ and $35\ ^\circ C$ → M = 0.028 kg/mol → 263 K

$$v_{rms} = \left(\frac{3RT}{M}\right)^{1/2}$$

$v_{rms} = ?$ 3.00

Wrong R!

$$v_{rms} = \left(\frac{3 \cdot 8.314\ J/mol\cdot K \cdot 263\ K}{0.0280\ kg/mol}\right)^{1/2} = 484\ m/s \text{ @ } -10^\circ C$$

$$v_{rms} = \left(\frac{3 \cdot 8.314\ J/mol\cdot K \cdot 308\ K}{0.0280\ kg/mol}\right)^{1/2} = 524\ m/s \text{ @ } 35^\circ C$$

Problem 2 (2 points)

Two identical balloons are each filled with gas to equal volumes. One balloon contains He and the other contains O_2. Identical pinholes are punched into both balloons at the same time, and it takes 73 s for the He balloon to deflate to half its initial volume. How long would you predict it will take the O_2 balloon to deflate to half its original volume?

$$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$$

$$\frac{r_{O_2}}{r_{He}} = \sqrt{\frac{4.00\ g/mol}{32.00\ g/mol}} = 0.354$$

O_2 leaks at 0.354 times the rate of He, so He time will be 0.354 times the O_2 time

$$t_{O_2} = \frac{t_{He}}{0.354} = \frac{73\ s}{0.354} = 206\ s$$

Problem 3 (1 point)

The van Der Waals equation improves the ideal gas law by adding in two new parameters: a and b

Briefly describe what physical properties each of these two parameters relates to:

a: Attractive forces between gas particles

b: The physical size of real gas particles