

Chemistry-4311
September 5, 2016

Quiz #1

Name Key

1. Matching (Use a letter only once)

In the van der Waals eq. $(P + an^2/V^2)(V - nb) = nRT$,
the "b" term corrects for the a of the gas molecules.

At constant n and T, the volume of an ideal gas is
g to pressure.

The equation for finding the expression for the average
speed $\langle c \rangle$ is e.

According to the kinetic theory of gases, the average
translational energy for a mole of N_2 molecules is f.

For an ideal gas $PV/(nRT)$ is d.

- a. volume
- b. $mv^2/2$
- c. proportional
- d. 1
- e. $\int c f(c) dc$
- f. $3RT/2$
- g. inversely proportional
- h. 0.5
- i. $\int c RT dc$
- j. attractive forces

1 2. Starting with the ideal gas law equation, show that $P = dRT/M$, where d is the density and M the molar mass.

$$PV = nRT = \frac{m}{M} RT$$

$$P = \frac{m}{V} \frac{RT}{M} = \frac{dRT}{M}$$

2 3. An ideal gas initially at 0.85 atm and 66 °C was allowed to expand until its final volume, pressure and temperature were 94 mL, 0.60 atm, and 45 °C. What was its initial volume?

$$PV = nRT$$

$$n = P_1 V_1 / RT_1 = P_2 V_2 / RT_2$$

$$V_1 = V_2 \times \frac{P_2}{P_1} \times \frac{T_1}{T_2}$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_1 = 94 \times \frac{0.60}{0.85} \times \frac{339}{318} = 71 \text{ mL}$$

2 4. A 1 atm gas mixture contains 12.0 grams of N_2 and 19.0 grams of O_2 ; $M_N = 16.0$ g and $M_O = 14.0$ g.

a. What are the mole fractions of N_2 and O_2 ?

$$\frac{12}{28} = 0.429 = n_{N_2}$$

$$\frac{19}{32} = 0.594 = n_{O_2}$$

$$n_T = 1.023$$

$$X_{N_2} = 0.429 / 1.023 = 0.419 = 0.42$$

$$X_{O_2} = \frac{0.594}{1.023} = 0.582 = 0.58$$

b. What are the partial pressures of N_2 and O_2 ?

$$P_i = X_i P_T$$

$$P_{N_2} = 0.42 \text{ atm}$$

$$P_{O_2} = 0.58 \text{ atm}$$