Chemistry-4311
September 6, 2013

Quiz #1 **Name** Key

1. Matching (Use a letter only once)

At constant n and P, the volume of an ideal gas is ___e___ to temperature.

The equation for the average speed of an ideal gas is found from ___a___.

$4.3 \times 10^4 \times 0.000020$ equals ___c___.

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

The ideal gas law equation is ___d___.

a. $\langle c \rangle = \int cP(c)dc$
b. $mv^2/2$
c. 0.86
d. $PV = nRT$
e. proportional
f. $3RT/2$
g. $\langle c \rangle = cP(c)$
h. $PT = nRV$
i. inversely proportional
j. 8.6×10^9

2. From the kinetic theory of gases PV for a mole of a pure gas equals $M\langle v^2 \rangle/3$, where M is the molecular weight and $\langle v^2 \rangle$ is the average of the squared velocities of the gas molecules. Show that the root-mean-squared velocity, $\langle v^2 \rangle^{1/2}$, is $(3RT/M)^{1/2}$.

For one mole

$$PV = M\langle v^2 \rangle/3 = RT$$

$$\langle v^2 \rangle = \frac{3RT}{M} \Rightarrow \langle v^2 \rangle^{1/2} = \left(\frac{3RT}{M}\right)^{1/2}$$

3. A pure gas at 1 atm pressure and 25 °C has a density of 1.8 g/L. What is the molecular weight of the gas?

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

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

Thus,

$$M = \frac{dRT}{P} = \frac{1.8\ g/L \times 0.08206\ \frac{L\text{-}atm}{mol\text{-}K} \times 298\ K}{1\ atm}$$

$$= 44\ g$$