

Chemistry-4311
September 8, 2017

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 "a" term corrects for the j 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 squared $\langle c^2 \rangle$ is i.

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

At constant T, V, and n, the pressure of Ar is higher
than that for He, since Ar is more massive (true, false)
h.

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

③ 2. A 1 atm gas mixture contains 30.0 grams of N_2 and 50.0 grams of O_2 ; $M_O = 16.0$ g/mole and $M_N = 14.0$ g/mole.

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

$$n_{N_2} = \frac{30.0}{28.0} = 1.07 \text{ moles}$$

$$n_{O_2} = \frac{50.0}{32.0} = 1.56 \text{ moles}$$

$$n_{\text{total}} = 2.63 \text{ moles}$$

$$x_{N_2} = 1.07/2.63 = 0.41$$

$$x_{O_2} = 1.56/2.63 = 0.59$$

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

$$P_i = x_i P_T$$

$$P_{N_2} = 0.41 \times 1 = 0.41 \text{ atm}$$

$$P_{O_2} = 0.59 \times 1 \text{ atm} = 0.59 \text{ atm}$$

② 3. The speed distribution is $f(c) = 4\pi [M/(2\pi RT)]^{3/2} c^2 \exp[-Mc^2/(2RT)]$.

a. On the back of this sheet give a representative plot of $f(c)$ versus c ; $f(c)$ on the y-axis and c on the x-axis. See Figure 2.11

b. Show how to determine the most probable value for c . You do not need to complete the math.

The expression for c_{mp} is found by
solving $d f(c)/dc = 0$ $c_{mp} = \left(\frac{2RT}{M}\right)^{1/2}$