

A few equations

$$PV = nRT$$

$$MM = d RT/P$$

$$P_{\text{tot}} = P_a + P_b$$

$$KE_{\text{ave}} = \frac{3 RT}{2 N_A}$$

$$\frac{1}{2}mv^2 = \frac{3 RT}{2 N_A}$$

$$c = \square\square$$

$$E_{\text{photon}} = h\nu$$

$$\Delta E = -R_H(1/n_f^2 - 1/n_i^2)$$

$$h\nu = R_H(1/n_o^2 - 1/n_h^2)$$

A few constants

$$R = 0.08206 \text{ L} \cdot \text{atm} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$$

$$R = 8.314 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$$

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$$

$$1 \text{ torr} = 1 \text{ mm Hg}$$

$$1 \text{ atm} = 101,325 \text{ Pa}$$

$$760 \text{ torr} = 1 \text{ atm}$$

$$0 \text{ }^\circ\text{C} = 273.15 \text{ K}$$

$$R_H = 2.18 \times 10^{-18} \text{ J}$$

$$h = 6.626 \times 10^{-34} \text{ J} \cdot \text{s}$$

$$c = 2.9979 \times 10^8 \text{ m/s}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$m_p = 1.6 \times 10^{-27} \text{ kg}$$

n has integral values 1,2,3...

l has integral values from 0 to $n - 1$

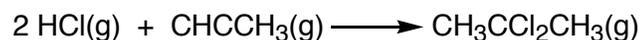
m_l has integral values between (and including) l
 to $-l$

m_s can be $+1/2$ or $-1/2$

$$0 \text{ }^\circ\text{C} = 273.15 \text{ K}$$

1. (16 pts.) Identical containers were each charged with a sample of gas at 300 °C. One container was charged with H₂ to a pressure of 1.5 atm and the other was charged with CH₃CH₂CH₃ to a pressure of 1.5 atm.
 - a. On average, H₂ molecules are moving slower, faster, or at the same speed as CH₃CH₂CH₃ molecules.
 - b. On average, the kinetic energy of an H₂ molecule is higher, lower, or the same as the kinetic energy of an CH₃CH₂CH₃ molecule.
 - c. The density of H₂ is higher, lower, or the same as CH₃CH₂CH₃.
 - d. The number of moles of H₂ is higher than, less than, or the same as the number of moles of CH₃CH₂CH₃.

2. (10 pts.) An electron moves from a 3p orbital to a 2s orbital.
- Is energy released or absorbed as the electron moves from the 3p to the 2s orbital.
 - Is a photon emitted or is a photon absorbed as the electron moves from the 3p to the 2s orbital.
3. (8 pts.) A reactor was charged with 3.50 atm of HCl and 6.0 atm of CH₃CCH₃. Determine the partial pressure of the CH₃CCl₂CH₃ that forms, the volume and the temperature of the reactor stays constant throughout the reaction.



4. (8 pts.) Calculate the energy of a photon that has a wavelength of 100.0 nm.
5. (8 pts.) Determine the ground state electron configuration of In.

12. (10 pts.) A 90.0-mL sample of hydrogen gas was collected by displacing water from an inverted beaker. The pressure of the gas in the beaker was 771 torr, the temperature of the gas in the beaker was 23.0 °C. The vapor pressure of water at 23.0 °C is 21.07 torr. Determine the number of moles of hydrogen in the flask.