Chemistry – 4311
December 11, 2012

Final Exam **Name** Key

(20) 1. Matching (use a letter only once)

70000 equals n.

In the van der Waals equation $[P + a(n/V)^2][V - nb] = nRT$ the $a(n/V)^2$ term corrects for o.

Average E_{trans} of a mole of ideal gas molecules is b.

The enthalpy H is defined as m.

Work for a reversible, isothermal expansion is h.

If the only work is P-V work, the heat for heating a substance at constant V is t.

At constant T and n, the pressure is d to the volume.

For a constant pressure process, work is q.

According to the first law of thermodynamics the change in the internal energy ΔU equals j.

If F(s) is the distribution of speeds for an ideal gas, the average speed is found from i.

a. $H = U - PV$

b. $3RT/2$

c. volume of molecules

d. inversely proportional

e. $\int C_V dT/T$

f. 7×10^{-4}

g. $\langle s \rangle = sF(s)$

h. $-nRT\ln(V_2/V_1)$

i. $\langle s \rangle = \int sF(s)ds$

j. $q + w$

k. $(P_2 - P_1)\Delta V$

l. proportional

m. $H = U + PV$

n. 7×10^4

o. molecular attractions

p. $-\Delta V / P_{ex}$

q. $-P_{ex}\Delta V$

r. ΔH

s. $Mv^2/2$

t. $\int C_V dT$

$c = 3.00 \times 10^8$ m/s

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

$R = 8.314$ J/mol-K

$R = 1.987$ cal/mol-K

$R = 0.08206$ L-atm/mol-K

$N_A = 6.02 \times 10^{23}$

1 atm = 101.325 kPa = 760 torr

F = 96,500 C/mole

(R 298 K)/F = 0.0257 V

$k_B = 1.381 \times 10^{-23}$ J/K

(10) 2. The reaction for combustion of naphthalene at 25 °C is

$$C_{10}H_8(s) + 12O_2(g) \rightarrow 10CO_2(g) + 4H_2O(l)$$

The heats of formation are:
$C_{10}H_8(s)$, 73.65 kJ/mol; $CO_2(g)$, - 393.51 kJ/mol, $H_2O(l)$, - 285.83 kJ/mol.

Calculate the enthalpy change ΔH° for this reaction.

$\Delta H_r^\circ = 4\times(-285.83) + 10(-393.51) - 73.65$

$= -5152.07$ kJ

(10) 2. One mole of an ideal gas at 300 K and a pressure of 15.0 atm expands isothermally and reversibly to a final pressure of 1.00 atm.
(a) Calculate the final volume V_2.

$V = \frac{nRT}{P} = \frac{1 \times 0.08206 \times 300}{1} = 24.6$ L

(b) Calculate w in L-atm.

$P_1 V_1 = P_2 V_2$

$P_1/P_2 = V_2/V_1$

$w = -nRT \ln V_2/V_1$

$= -0.08206 \times 300 \times \ln 15/1$

$= -66.6$ L-atm

(15) 4. At 1 atm pressure and 298 K a certain gas has a density of 1.23 g/L. What is the molar mass of the gas?

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

$PM = \frac{w}{V} RT = dRT$

$M = \frac{dRT}{P} = \frac{1.23\ g/L \times 0.08206 \times 298}{1} = 30.08$ g