Final Exam   Name_____Key_____

(20) 1. <u>Matching</u> (use a letter only once)

70000 equals __n__.   a. $H = U - PV$

In the van der Waals equation $[P + a(n/V)^2][V - nb] = nRT$ b. $3RT/2$
the $a(n/V)^2$ term corrects for __o__.

c. volume of molecules

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

d. inversely proportional

The enthalpy H is defined as __m__.

e. $\int C_V dT/T$

Work for a reversible, isothermal expansion is __h__.

f. 7×10^{-4}

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

g. $<s> = sF(s)$

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

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

i. $<s> = \int sF(s)ds$

For a constant pressure process, work is __q__.

j. $q + w$

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

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

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

l. proportional

$c = 3.00 \times 10^8$ m/s $F = 96{,}500$ C/mole

m. $H = U + PV$

$h = 6.626 \times 10^{-34}$ J s $(R\ 298\ K)/F = 0.0257$ V

n. 7×10^4

$R = 8.314$ J/mol-K $k_B = 1.381 \times 10^{-23}$ J/K

o. molecular attractions

$R = 1.987$ cal/mol-K

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

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

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

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

r. ΔH

1 atm $= 101.325$ kPa $= 760$ torr

s. $Mv^2/2$

t. $\int C_V dT$

1

(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 $\Delta H°$ for this reaction.

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

$$= -5152.07 \, kJ$$

(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.

$$P_1 V_1 = P_2 V_2$$

$$P_1/P_2 = V_2/V_1$$

$$W = -nRT \ln V_2/V_1$$

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

$$= -66.6 \, L\text{-}atm$$

(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?

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

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

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