CHEM 323
Fall 2008
Post-Exam 1
Due October 13, 2007 at 5:00 PM

Name: _____

Instructions
Fill in only the answers below. Attach your work to these cover pages, but do not include the questions. Sign the affidavit at the bottom of the second page. A link to the full contest rules is posted on the *Announcements* section of the class web page.

1a. w = _____

q = _____

ΔS = _____

b. w = _____

q = _____

ΔS = _____

2a. $\Delta_f U^0$ (CO, g) = _____

$\Delta_f U^0$ (CO_2, g) = _____

b. ΔU^0 = _____

c. ΔA^0 = _____

3a.

Engine	Efficiency
A	
B	
C	
D	

b. The impossible engines are _____

4a. p_{Cu} = _____

p_{He} = _____

5. C–H bond dissociation energy = _____

By my signature below I attest that I have abided by all the rules set forth on the web page.

_____ _____

Signature Date

Instructor Use Only!

Number correct	
Work included	
Instructions followed	
Total	

DO NOT TURN THESE QUESTIONS IN WITH THE ANSWER SHEET

1a. A sample consisting of 0.500 moles of helium gas is expanded isothermally and reversibly from a volume of 2.00 L to 10.0 L at 27.0 °C. Determine w, q, and ΔS for this process. You may assume that He behaves as an ideal gas under these conditions with $C_{V,m} = \frac{3}{2}R$.

b. If this expansion occurred reversibly and adiabatically, what would be w, q, and ΔS for the process?

2a. An internal energy of formation, $\Delta_f U^0$ (defined in the same way as enthalpies of formation, $\Delta_f H^0$) may be calculated from the corresponding $\Delta_f H^0$. From the data given below calculate $\Delta_f U^0$ for CO_2 and CO at 298.15 K. Assume all gases are ideal.

Species	$\Delta_f H^0$ (kJ/mole)	S^0 (J/K·mole)	$\Delta_f G^0$ (kJ/mole)
CO (g)	-110.53	197.67	-137.17
CO_2 (g)	-393.51	213.74	-394.36
O_2 (g)	0	205.138	0

b. Determine ΔU^0 for the reaction 2 CO (g) + O_2 (g) → 2 CO_2 (g).

c. What is ΔA^0 for this reaction at 298.15 K?

3a. Calculate the efficiency of these four heat engines, each operating between temperature reservoirs at 200.0 °C and at 0.0 °C, and each claiming to produce 1000 watts of useful output power.

Engine	**Power Input (watts)**
A	900
B	1500
C	2500
D	3000

b. Which engines are impossible?

4. For copper at 293.0 K the isothermal compressibility, κ_T, is 0.735×10^{-6} atm^{-1}. Calculate the pressure required to give a 0.050% decrease in copper's volume and the pressure required to bring about the same change in an equal volume of He at 1.00 atm of pressure and 293.0 K. Treat He as an ideal gas.

5. From the $\Delta_f H^0$ for C (g), H (g) and CH_4 (g), calculate the C–H bond dissociation enthalpy.