CHEMISTRY 107 Test #3 Name _____
SECTION 01 8:00 am - 8:50 am Tuesday, October 22, 1996

(1.) The combustion of acetaldehyde, CH_3CHO, is shown below. Please balance the equation (5 points). Now, given the following standard values, please calculate ΔH^o for the reaction (15 points).

$CH_3CHO\ (g) + O_2\ (g) \text{ ----------> } CO_2\ (g) + H_2O\ (l)$

$\Delta H_f^o\ CH_3CHO\ (g) = -167.0$ kJ/mole; $\Delta H_f^o\ CO_2\ (g) = -393.5$ kJ/mole;

$\Delta H_f^o\ H_2O\ (l) = -285.9$ kJ/mole

Please write the thermochemical equation for the formation of 1 mole of acetaldehyde from its elements in their standard states (5 points).

(2.) Elemental germanium can be produced by reaction of its oxide with aluminum as shown below. Please balance the equation (5 points). Given that DH^o for the reaction of 1 mole of GeO_2 (s) is -578.5 kJ, and $\Delta H_f^o\ Al_2O_3$ (s) = -1669.8 kJ/mol, what is $\Delta H_f^o\ GeO_2$ (s)? (15 points).

$GeO_2\ (s) + Al\ (s) \text{ ----------> } Al_2O_3\ (s) + Ge\ (s)$

Please draw an energy level diagram for the balanced thermochemical equation (5 points).

(3.) What is the wavelength of the photon emitted when the electron in the hydrogen atom drops from the 6th Bohr orbit to the 2nd Bohr orbit? (10 points). What is the energy of this radiation? (5 points). In which region of the electromagnetic spectrum does this radiation reside? (5 points). A line in the ultraviolet region has a wavelength of 397 nm; this emission is also associated with "electron drop" to the 2nd Bohr orbit. Please determine from which higher Bohr orbit the electron originated (5 points).

(4.) (i) Please give the shorthand electronic configurations of the following: Cs, I, Ga, Bi, Cd (5 points).

(ii) Please draw orbital diagrams for the valence electrons of the following: As, Si, Cl, Be, Fr (5 points).

(iii) In each of the following pairs, which species is the smaller? (5 points).

Na, Al; Na^+, Al^{3+}; Li^+, Be^{2+}; Na, K; S, O

(iv) Give the name and *complete* electronic configuration of the element with which Rb^+, Sr^{2+}, Se^{2-}, and Br^- are isoelectronic. (5 points) Please draw an Aufbau diagram for this element showing the filled orbitals, and please clearly label the orbitals. (5 points).