City College, Chemistry Department
Chemistry 10301, sections T and T2, Prof. T. Lazaridis
Third Midterm exam, Nov 30, 2006
Name (last name first): _____
I.D. Number: _____
Workshop leader: _____

Note: There are 10 questions in this exam. Fill in your answer in the blank space provided immediately following each question. 1/2 point will be subtracted every time you report a numerical result with an incorrect number of significant figures.

Useful data: **Speed of light : 2.9979×10^{8} m/s**
Planck's constant : 6.626×10^{-34} Js
$E_n = -2.179 \times 10^{-18}$ J/n^2

1. (5) A diode laser emits at a wavelength of 987 nm. All of the radiation it emits is absorbed in a detector which measures a total energy of 0.52 J over a period of 32 sec. How many photons per second are being emitted by the laser?

2. (5) Give the values for the quantum numbers n, l, m_l for each orbital in the 4d subshell.

3. (10) Write the noble-gas core abbreviated electron configurations of the following elements:

a) Ca

b) Ge

4. (10) Using orbital diagrams, determine the number of unpaired electrons in each of the following atoms:

a) As

b) Fe

5. (5) Use the periodic table to predict which atom in the following pair has the smaller first ionization energy:

K or Ca

6. (5) Use the periodic table to predict which atom in the following pair has the higher electronegativity:

Si or Cl

7. (20) Draw a Lewis structure that obeys the octet rule for each of the following molecules or ions and indicate the formal charge on each atom:

a) PO_3^{3-}

b) H_2CO (both H atoms are bonded to C)

8. (10) Draw two Lewis structures for perbromic acid (HBrO4), one that satisfies the octet rule and one that has the least formal charge (reminder: for all acids, H is bonded to O).

9. (15) Draw the possible resonance structures for nitrous acid (HNO_2) and indicate which one(s) contribute more and why.

10. (15) Use data provided (and the ionization energy of hydrogen, which is 1312 kJ/mol) to estimate the enthalpy of the following gas phase reaction:

$$HF\,(g) \text{ ---------> } H^+(g) + F^-(g)$$