

**City College, Chemistry Department
Chemistry 10301, sections L and L2, Prof. T. Lazaridis
Third Midterm exam, Dec 4, 2001**

Name (last name first): _____

I.D. Number: _____

Workshop leader: _____

Note: There are 7 questions in this exam. Fill in your answer in the blank space provided immediately following each question. One 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/n²

1. The electron in a hydrogen atom drops from the excited state with $n=3$ to the ground state, emitting a photon.
 - a. (5) What is the energy of this photon?

b. (5) What is the wavelength of this photon?

c. (5) How many electrons in an atom can have principal quantum number $n= 3$?

2. a. (5) Write three structural isomers of hexane (C_6H_{14}).

b. (5) Write the following bonds in order of increasing polarity:
C-C, C-N, C-O

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3. a. (4) Write the ground state configuration of chlorine using a noble gas core

b. (3) Draw an orbital diagram for this atom

c. (3) Is Cl diamagnetic or paramagnetic?

4. a. (4) What is the electron configuration of Ni^{+2} ?

- b. (4) What is the electron configuration of S^{2-} ?
- c. (2) Which one is larger in size, S or S^{2-} ?
5. a. (5) Write Zr, V, and Mn in order of increasing atomic radius
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- b. (5) Write O, N, P in order of increasing ionization energy
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- c. (5) Write the atoms O, F, S in order of increasing electronegativity
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6. a. (15) Draw two Lewis structures for the chlorite ion (ClO_2^-), one satisfying the octet rule and one with the least formal charge. Indicate the formal charge on each of the atoms.

b. (5) What is the geometry of this ion (tetrahedral, linear, trigonal, etc) and the approximate value of the O-Cl-O bond angle?

c. (5) Chlorine dioxide gas (ClO_2) was recently proposed as a substance that can kill anthrax bacteria. Propose a Lewis structure for it.

d. (5) Which one is a free radical, ClO_2 or ClO_2^- ?

7. (10) Estimate the enthalpy of the following reaction using the bond energies for C-H (413 kJ/mol), O=O (498.3 kJ/mol), C=O (802 kJ/mol), and O-H (463 kJ/mol).

