Chemistry 211 Name: _____
Fall 2024 Please Print
Test 3

Multiple Choice: (4 points each. Put answers in left margin as capital letters.)
$h = 6.626 \times 10^{-34}$ J•s

1. What is the oxidation number of the nitrogen atom in $Ca(NO_2)_2$?

A) -3 B) -1 C) +1 D) +3 E) +5

2. What is ΔH for the net reaction below?

$H_{2\,(g)} + F_{2(g)} \longrightarrow 2\,HF_{(g)}$ ΔH = -537 kJ
$C_{(s)} + 2\,F_{2\,(g)} \longrightarrow CF_{4\,(g)}$ ΔH = -680 kJ
$2\,C_{(s)} + 2\,H_{2\,(g)} \longrightarrow C_2H_{4\,(g)}$ ΔH = 52.3 kJ
$C_2H_{4\,(g)} + 8\,F_{2\,(g)} \rightarrow 2\,CF_{4\,(g)} + 4\,HF_{(g)}$ ΔH = ?

A) -2486 kJ B) -1702 kJ C) -1165 kJ D) 234 kJ E) 1165 kJ

3. Which of the following is false?

A) The energy of any electron in a hydrogen atom depends only on n.
B) A node (or nodal surface) is a place of zero electron density.
C) In any atom, no two electrons may have the same four quantum numbers.
D) The lowest energy state for an atom is its ground state.
E) Effective nuclear charge is the number of protons in an atom.

4. The electrons in which orbital type shields **most poorly**?

A) *d* B) *f* C) *p* D) *s*

5. The $\ell = 2$ subshell may hold a maximum of _____ electrons.

A) 1 B) 2 C) 6 D) 10 E) 14

6. Which of the following is isoelectronic to Y^{3+}?

A) Ag^+ B) K^+ C) Kr D) Se^{2-} E) Zr^{2+}

7. With respect to electronegativity values,

A) B > N > Al B) Al > N > B C) N > B > Al D) B > Al > N E) Al > B > N

8. Four of the following five statements are almost always true of compounds possessing ionic bonds. Which one is not?

A) Compounds that dissolve well in water.
B) Compounds that are solids at room temperature.
C) Compounds that are brittle.
D) Compounds that conduct electricity well when liquids.
E) Compounds that are hard.

9. Nitrogen tends to form _____ covalent bonds.

A) 1 B) 2 C) 3 D) 4 E) 5

Discussion Questions: (You must show your work to receive credit.

1. What is the balanced equation for the reaction of solid iron(III) hydroxide with aqueous perchloric acid to yield iron(III) perchlorate and water? (6 points)

2. When a 5.00 g sample of KCl is dissolved in water in a calorimeter that has a total heat capacity of 3.04 $kJ \bullet K^{-1}$, what is the final temperature if the molar heat of solution is 17.2 kJ/mol and the initial temperature is 25.00 ºC. (4 points)

3. Write out the electron configuration of the following and provide the number of unpaired electrons on each (10 points)

   Re: Cr^{3+}:

4. A minimum energy of 941 kJ/mol is required to break the bond in N_2. What wavelength of light is required to break the bond in a molecule of nitrogen? Is this the minimum or maximum wavelength necessary? Explain. [NB: It's possible to answer part 2, even if you cannot answer part 1.] (12 points)

5. What are the 3 biggest differences between the Bohr/Rutherford and Schrödinger/quantum mechanical models of atoms? (i.e. Do a brief comparison and contrast.) (10 points)

6. Based on their positions in the periodic table, predict which atom of the following pairs will have the larger atomic radius. Provide the physical rationale for your choices. (10 points)

   a) O, Ne –

   b) Mg, Sr –

7. Draw the Lewis structures of PCl_3 and H_3PO_4. Which is the most electronegative element in each molecule? (12 points)