General Chemistry I NAME: _____
Chem 111 Exam #3 November 30, 2012 Version #26

Some Equations and Constants for your use:

$\lambda \times \nu = c$ $E = h\nu$ $E_n = \frac{-2.18 \times 10^{-18}\ J}{n^2}$ $\lambda = \frac{h}{mv}$

$\Delta H^o_{rxn} = \sum$ energies of bonds broken $- \sum$ energies of bonds formed

$c = 3.00 \times 10^8$ m/s $h = 6.626 \times 10^{-34}$ J • s

SHOW ALL WORK

1. 8 points

Consider electromagnetic radiation that delivers 2.00 x 10^{-19} J for each photon.

a. What is the frequency of the radiation, in Hz?

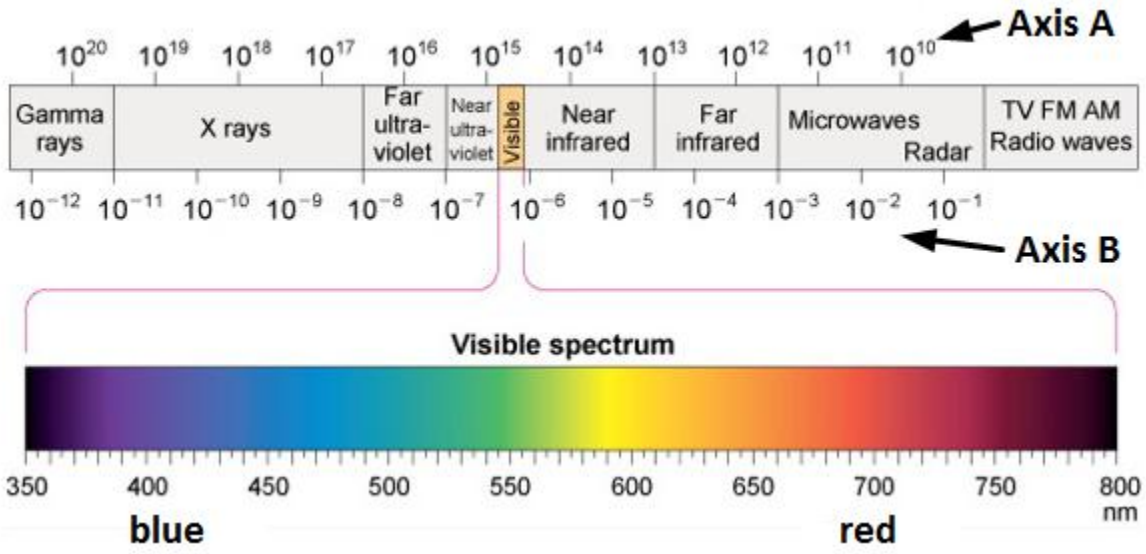
_____

b. What is the wavelength of this light, in nm?

_____

2. 4 points

Consider the electromagnetic spectrum below.



a. Give the correct label for Axis A: _____

b. Give the correct label for Axis B: _____

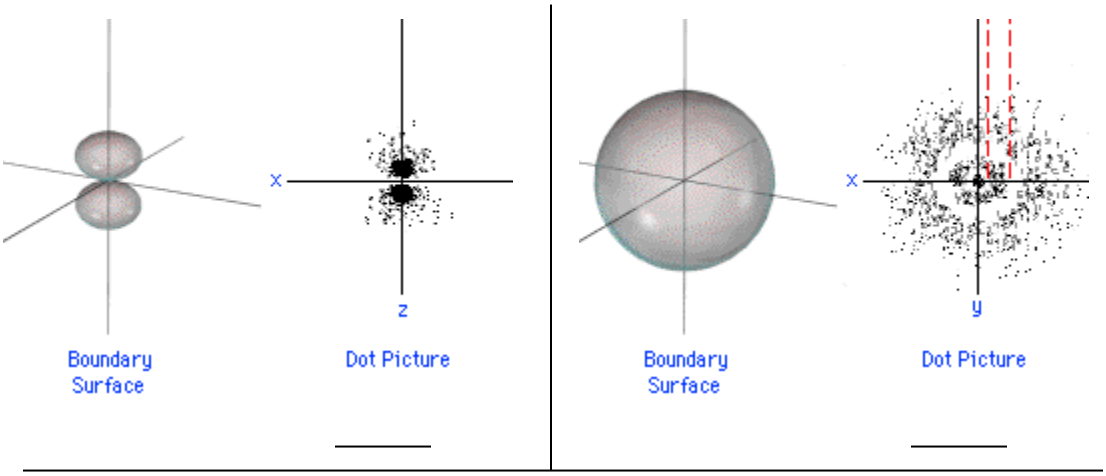
c. Which type of light has greater energy per photon? Radio or IR

d. Which type of light has greater frequency? X-rays or UV

3. 8 points
Fill in the following chart regarding orbitals.

	number of orbitals	number of electrons that be can held
n = 3 shell	_____	_____
4p subshell	_____	_____
$3p_x$	_____	_____
2f subshell	_____	_____

4. 4 points
Give the orbital designation for each orbital pictured. For example, 2s or $4p_x$.



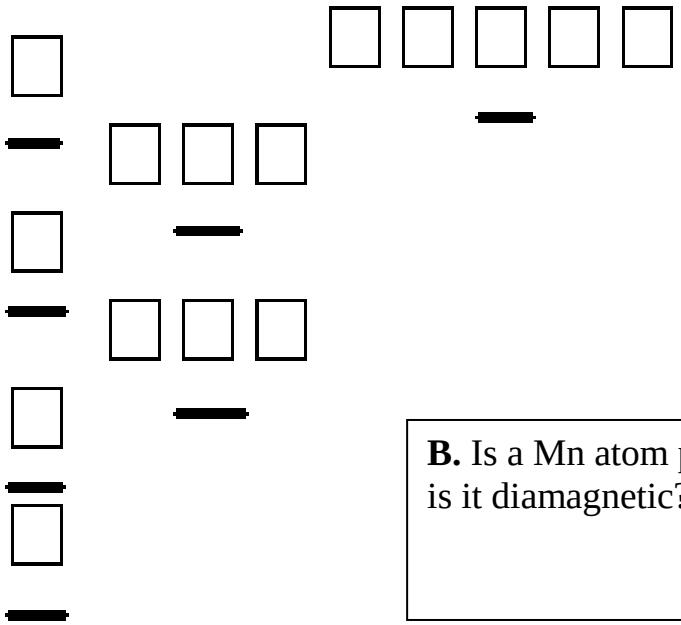
_____ _____

5. 4 points
For the orbital above on the left: how many planar nodes? _____

how many spherical nodes? _____

6. 7 points

A. Fill in the following charts to show the electron configuration of Mn. You need to fill in electron arrows and fill in the blanks below the boxes with what is appropriate to go there. That is, for each of the thick lines, you need to indicate what goes there in the diagram.



B. Is a Mn atom paramagnetic, or is it diamagnetic?

7. 4 points

In any format you prefer, indicate the electron configurations for each of the following:

a. Si

c. the Mn^{3+} ion

8. 4 points

For *each pair*, indicate which is higher in energy:

a. the 2p orbitals of C or the 3p orbitals of Si

b. the highest energy electron in Na or the highest energy electron in Mg

9. 4 points

For *each pair*, which bond is longer?

a. C-C or C-O

b. C-C or C=C

10. 8 points
For each pair, indicate which is larger:

a. ionization energy of Li	or	ionization energy of F
b. radius of C	or	radius of Si
c. radius of F^-	or	radius of F^+
d. size of the ion made by Na	or	size of the ion made by O

11. 4 points

What is ΔH for the following reaction? $N_2(g) + 3\ F_2(g) \longrightarrow 2\ NF_3(g)$
Bond energies:

N≡N = 945 kJ/mol
F-F = 155 kJ/mol
N-F = 283 kJ/mol

12. 12 points
Draw Lewis Dot structures for the following:

SO_2

$CHCl_3$ (all atoms bonded to C)

$SeCl_4$

13. 4 points
What is the driving force causing the formation of a covalent bond between two atoms? *Choose one.*

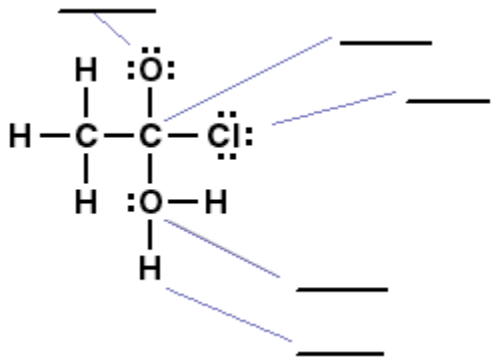
a. the ability to fill valence shells, usually with an octet of 8 electrons

b. the ability for electrons on one atom to be near the nucleus of another atom

c. the ability of electrons to "pair up" with other electrons from other atoms

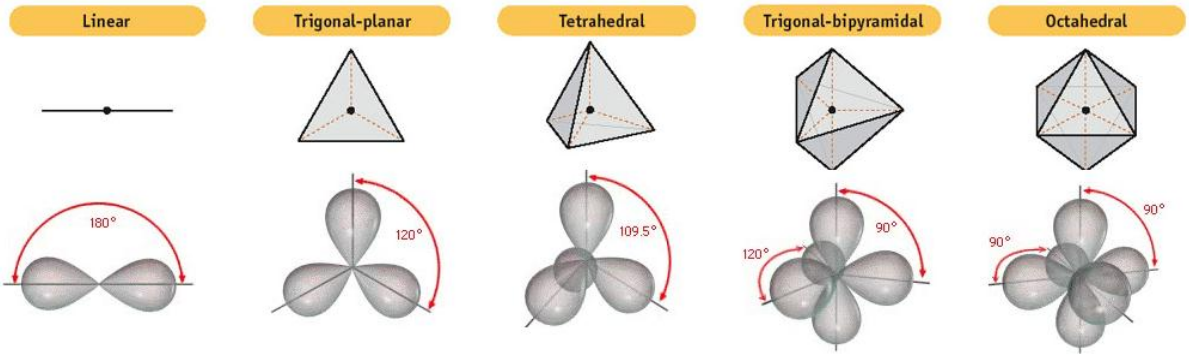
d. the ability of two nuclei to be closer to each other, increasing the strong nuclear force

14. 5 points
Give the formal charge for each of the noted atoms in the following Lewis structure.



16. 5 points
In the area below, sketch what the periodic table would look like if *all* orbital subshells could have exactly two orbitals instead of the way it really works (s = 1 orbital, p = 3 orbitals, d = 5 orbitals, etc.). Include just boxes in appropriate rows and columns, and do so for the first 4 periods of the periodic table. **Do not** put in element symbols. You're making a picture with a bunch of properly positioned boxes.

17. 15 points



For each of the following molecules, give the electron-pair geometry, the molecular geometry, the bond angles, and determine the molecular polarity. Space is given to show your work.

SO_2

electron-pair geometry:

molecular geometry:

bond angles:

polar or nonpolar?

SO_3

electron-pair geometry:

molecular geometry:

bond angles:

polar or nonpolar?

SF_2

electron-pair geometry:

molecular geometry:

bond angles:

polar or nonpolar?