I apologize for the spraeling messiness of this packet. It is a combination of 1) things to know 2) unsolved problems 3) solved problems. It is a broad survey meant to be a starting point that jogs your memory.

Review for the June 2014 Chemistry Final Exam

(The exam covers only second semester, from Jan 27 to June 6th)

Disclaimer: Studying this packet is a great start but is not a substitute for actually studying all 80 days of material. Hopefully time spent with this packet will help you find what parts of the semester you need to go back and study in depth, either from your notes or from http://genest.weebly.com

Of the 80 days we have been together this semester, the things in this packet are the ones that came up over and over.

About a third of what you need to know are specific facts. Get these from your notes.

Two thirds of what you need to know are skills. Get these by doing, redoing, and redoing one more time, all of the old homework problems that you learned to solve this semester.

UNIT 12 ELECTRON CONFIGURATIONS OF ATOMS

VOCABULARY

1. atomic orbital
2. electromagnetic radiation
3. e- configuration
4. energy level
5. photon
6. quantum
7. quantum mechanical model
8. NO MATH FROM page 385 (chapter13)

Vocabulary from page 408:

9. atomic radius trend and definition
10. electronegativity trend and definition
11. energy of successive ionizations

1. Give the number of protons, neutrons, and electrons in each

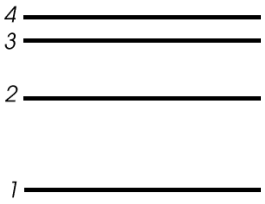
_____p _____n ____e Mg^{2+} with an atomic mass number of 25

2. Fill in all nine missing blanks

Table of Electromagnetic radiation - showing all forms, including, at the middle, the colors of visible light

_____	_____	_____	R	O	?	?	B	?	?	_____	_____	Gamma Radiation
Least energy												Most energy

3. Draw the dot-dash and circles electron configurations for an atom with 5 electrons and 5 protons.



The figure on the left represents the orbits of a Bohr atom. Orbit 1 is closest to the nucleus. Orbit 4 is farthest from the nucleus.

1. How many different energies could an electron give off it were jumping among this set of orbits?

   a) 4 b)6 c)10 d)12

2. Which electron motion starting from energy level Two would cause the atom to emit (give off) a photon?

   a) 2→ 1 b)2→ 3

.

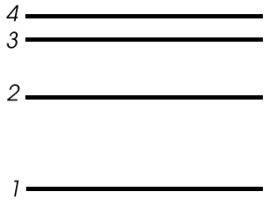
3. Which electron motion starting from energy level Two would cause the atom to absorb a photon?

   a) 2→ 1 b)2→ 3

1. (Fill in the blanks by using the words low or high)

Each element produces a unique set of emission or absorption lines. An emission spectrum involves transitions of electrons from _____ to _____ energy states. An absorption spectrum involves transitions of electrons from _____ to _____ energy states. These transitions occur **only** between discrete energy levels, and thus the lines occur **only** at certain wavelengths and at no

others.



2. Consider just four of the energy levels in a certain atom, as shown in this diagram:

a. draw arrows indicating all the possible transitions for an electron jumping **up** between any of the levels.[Hint: there are six possible]

b. How many different colors of light will be emitted when the electron moves **down** among these levels?
_____

c. Which transition corresponds to the highest energy light emitted?
From n = _____ to n = _____ .

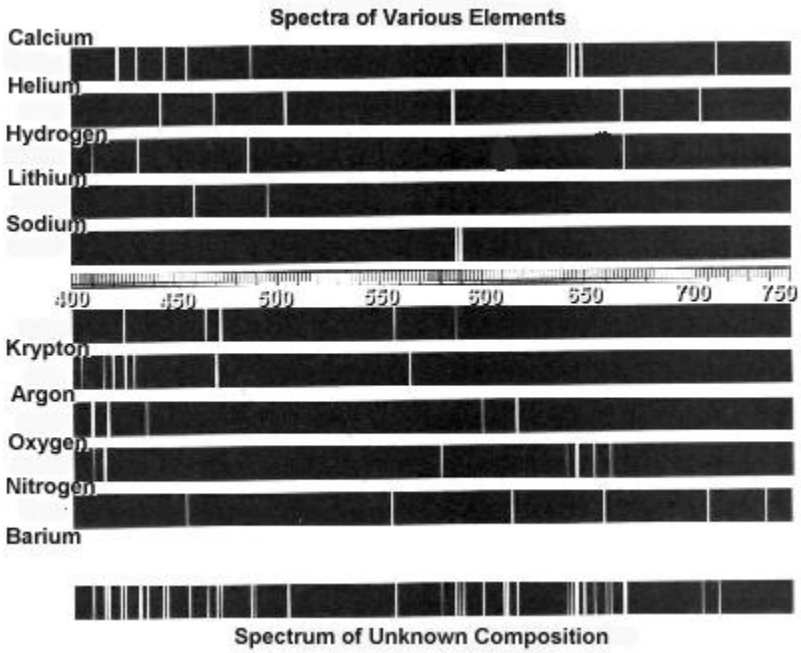
d. Which transition corresponds to the smallest energy light emitted?
From n = _____ to n = _____ .

e. Which transition corresponds to the highest energy of heat absorbed?
From n = _____ to n = _____ .

f. Which transition corresponds to the smallest energy heat absorbed?
From n = _____ to n = _____ .

3. How can a hydrogen atom, which has only one electron, have so many spectral lines?

4. What elements are present in the object that produced the "Spectrum of Unknown Composition"? Explain your method and relate this activity to the way astronomers use spectra to identify the composition of a star.



5. Which of the following electron transitions in a hydrogen atom will emit a photon, which absorb a photon? (How do you know?)

   A. n = 1 to n = 3
   B. n = 4 to n = 3
   C. n = 3 to n = 2
   D. n = 3 to n = 1
   E. n = 2 to n = 3

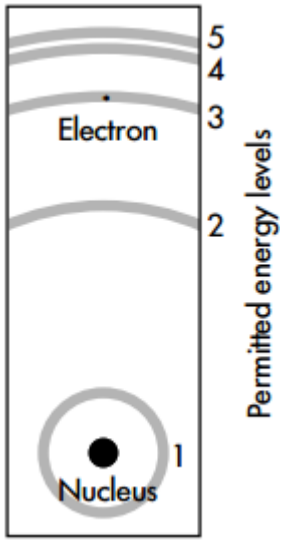
5B. Which of the above electron transitions in a hydrogen atom will result in emission of light with the most energy?

7. List the ***visible spectrum*** in order from lowest energy to highest energy, from memory:

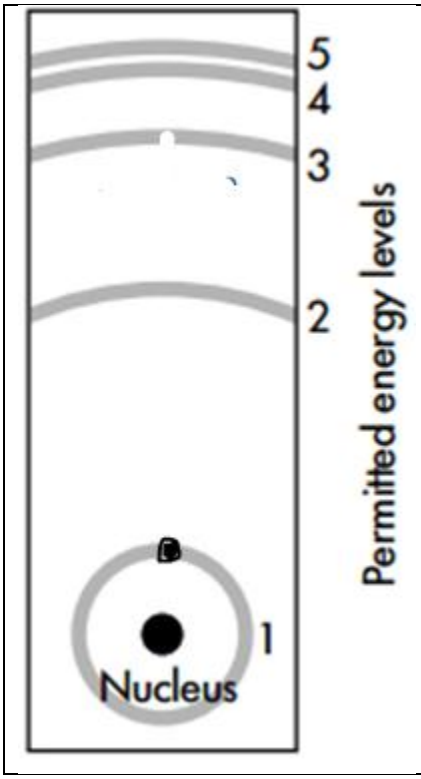
_____ _____ _____ _____ _____ _____ _____

lowest energy **highest energy**

Remember: An electron can move from a lower to a higher energy level by absorbing a photon. An electron can move from a higher to a lower energy level by emitting a photon.

On these diagrams, only consider the five lowest permitted orbits/energy levels in a hydrogen atom, and that the amount of jump between levels is correlated to the energy of the photon that is absorbed or emitted. An electron is currently in energy level 3, as shown at right. Clearly circle your answers below. (a) Which electron jump starting from energy level 3 would emit the highest-energy photon? 3→ 5 3 →4 3→ 2 3 →1 (b) Which electron jump starting from energy level 3 would emit the lowest-energy photon? 3 →5 3 →4 3→ 2 3 →1 (c) Which electron jump starting from energy level 3 would absorb the highest-energy photon? 3 →5 3→ 4 3→ 2 3 →1 . (d) Which electron jump starting from energy level 3 would absorb the lowest-energy photon? 3 →5 3 →4	

3→ 2 3→ 1	

	Now consider an electron currently in the ground state (energy level 1), as shown at right. Clearly circle your answers below. (e) Which electron jump starting from energy level 1 would absorb the highest-energy photon? 1→ 5 1→ 4 1→ 3 1→ 2 . (f) Which electron jump starting from energy level 1 would absorb the lowest-energy photon? 1→ 5 1→ 4 1 →3 1→ 2

6. Explain why it is not possible for a ground state electron to emit a photon.

7. What is the difference between the ground state and the excited state of electron positions?

8. What does an atom do to emit a photon?

From memory, list the 3 types of radiation on the electromagnetic spectrum that are too high energy for the human eye to detect:

a. c.

b.

9. From memory, list the 3 types of radiation on the electromagnetic spectrum that are too low energy for the human eye to detect:

1. How many elements are there in Group 1?

2. Which element in Period 4 has the largest radius?

3. For a neutral atom of fluorine [in the ground state],
   a. How many electrons should it have? _____

b. write the boxes and arrows electron diagram	c. write the shorthand abbreviation of the electron diagram
d. write a Bohr circle and nucleus diagram	e. write the shorthand for the Bohr diagram

4. For a neutral atom of magnesium [in the ground state],
    a. How many electrons should it have? _____

b. write the boxes and arrows electron diagram	c. write the shorthand abbreviation of the electron diagram
d. write a Bohr circle and nucleus diagram	e. write the shorthand for the Bohr diagram

5. For the second element in Period 6,
    a. The name of this element is _____
    b. If this neutral element lost electrons it would become (positive / negative).
    c. Predict the oxidation state of this element after it forms its ion _____
6. When neutral $^{33}_{16}S$ changes into an ion, it will be a (cation / anion) with a charge of _____.
    a. $^{33}_{16}S$ has _____ protons _____ electrons _____ neutrons
    b. the ion version of the above atom has _____ protons _____ electrons _____ neutrons

7. Write the electron configuration (letters and numbers, starting with $1s^2$ $2s^2$…, , no boxes and arrows) for a Ca^{2+} ion

8. Which element in Period 4 is the easiest to steal an e- from?

9. Circle one or more elements that would be expected to have very similar properties to oxygen:

   Nitrogen Osmium Sulfur Fluorine

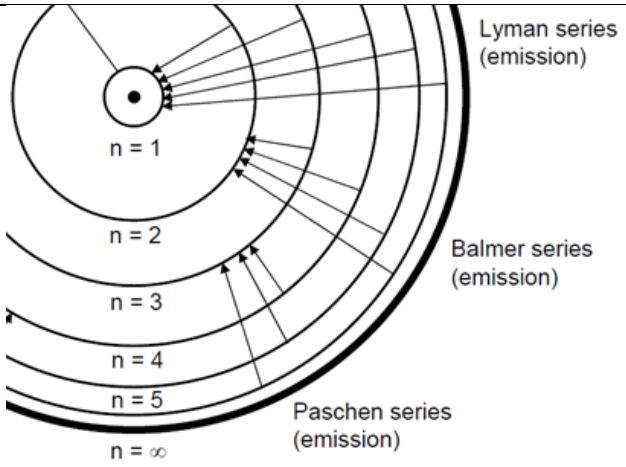
10. In each blank write <, =, or > to describe the amount of electrons in the two things:
    a. a neutral sodium atom _____ a sodium ion
    b. a Sr atom _____ a Sr^{2+} ion

11. Which one of these series of drops would most likely give off only infrared light?
    Lyman / Balmer / Paschen

12. Which one of these series of drops would most likely give off only visible light?
    Lyman / Balmer / Paschen

13. Which one of these series of electron drops would most likely give off only ultraviolet light?
    Lyman / Balmer / Paschen

14. These series of energy transitions are named for their discoverers. Which emission series was probably the most dangerous to be viewing without eye protection?
    Paschen Balmer Lyman



UNIT 13 BONDS , POLAR BONDS, AND POLAR MOLECULES

VOCABULARY

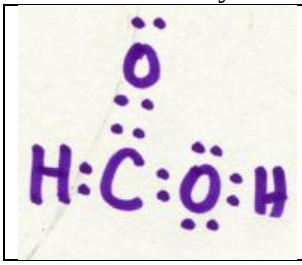
1. a electron dot structure (interpret it if given the drawing but DON'T have to make it from scratch) (know double, single, triple bonds exist and contain two e- each BUT don't need to call them pi, sigma, and don't need to know 3D shape)
2. ionic bond
3. metallic bond
4. octet rule
5. valence e-
6. dipole
7. dipole interaction
8. dispersion force
9. double covalent bond
10. hydrogen bond
11. nonpolar covalent bond
12. polar bond
13. polar covalent bond
14. polar molecule
15. structural formula
16. tetrahedral angle
17. triple covalent bond
18. unshared pair
19. van der Waals force
20. VSEPR theo

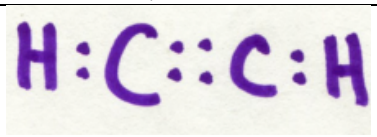
1. How many valence e- are in an atom that is $1s^2 2s^1 2p^5$?
2. What two types of elements will combine to form a
   a. ionic bond?

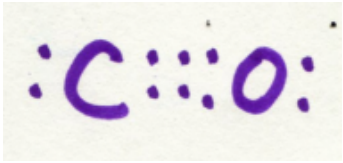
   b. metallic bond?

   c. covalent bond?

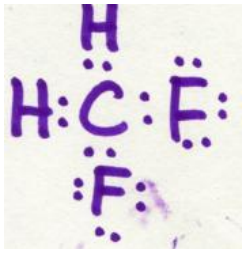
3. Atoms are stable when they have either an octet of e- (eight e- around most elements) or a duet of e- (two e- around beryllium, lithium, hydrogen, helium). draw a circle around each stable atom. If you find an unstable atom, write UNSTABLE next to it.

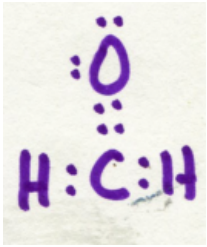


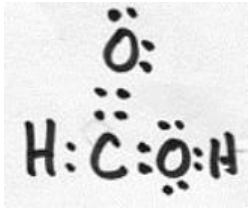




4. Convert these dot-drawings to line-shorthand drawings.







5. For the molecule shown here,
   a. What is the formula of the substance? (e.g. the formula of water would be written H_2O)
   b. how many bonds does it have?
   c. altogether, how many e- are in bonds?
   d. altogether, how many e- are nonbonding?
   e. how many valence e- altogether?

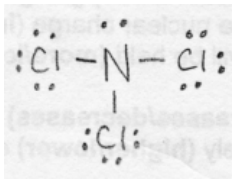
6. Why do the electrons hold together atoms in a
   a. ionic bond?
   b. metallic bond?
   c. covalent bond?

7. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$ has ____ valence e- . Its dot symbol is…

8. Draw the electron dot symbol for a neutral atom of each:
   a. calcium
   b. chlorine

9. (Circle one) **Ionic bonds** are usually formed when nonmetals react with (metals/nonmetals)
10. (Circle one) **Covalent bonds** are usually formed when nonmetals react with (metals/nonmetals)
11. (Circle one) **Metallic bonds** are usually formed when metals react with (metals/nonmetals)

1. How many valence e- are in an atom that is $1s^2 2s^2 2p^6$?

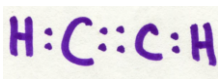


2. For the molecule shown here,
   (a) What is the formula of the substance? (e.g. the formula of water would be written H_2O)
   (b) how many bonds does it have?
   (c) altogether, how many e- are in bonds?
   (d) altogether, how many e- are nonbonding?
   (e) how many valence e- altogether?

3. (Circle one) **Covalent bonds** are usually formed when nonmetals bond with (metals/nonmetals)

4. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$ has ____ valence e- . Its dot symbol is…

5. Under each molecule circle a choice, based on whether all the atoms are obeying the octet / duet rule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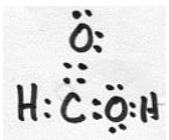
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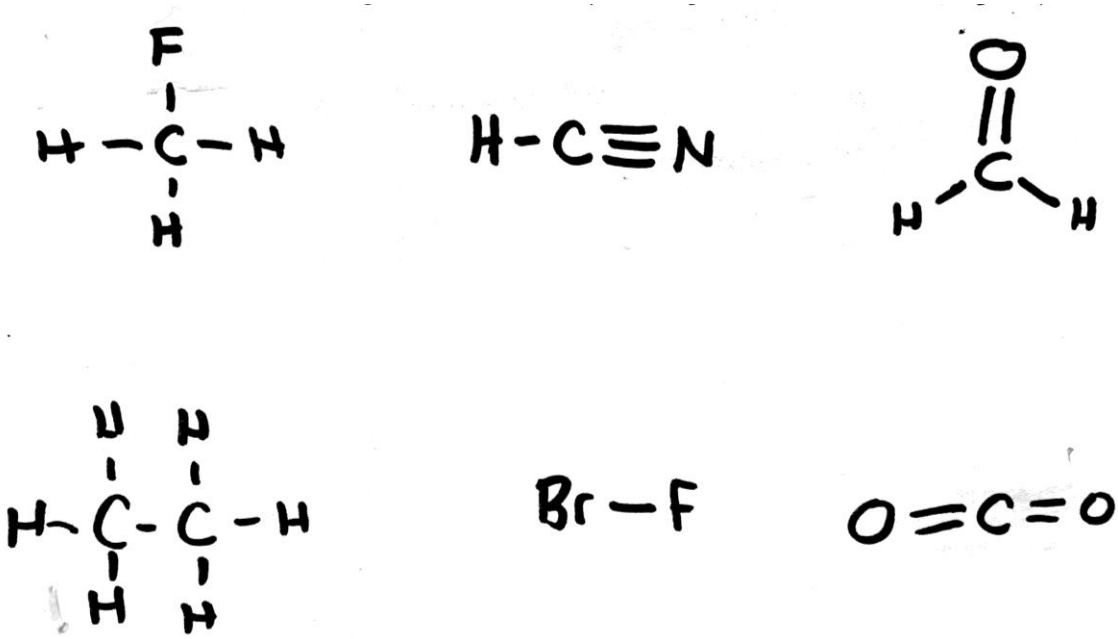
1. For these covalent bonded pairs, write a ∂+ or ∂- next to each end to show where there is greater electron density *according to each element's electronegativity*

2. For these covalent bonded molecules, look at one covalent bond at a time. Next to each atom, write the electronegativity number (look it up in a table). Draw an arrow, parallel to each bond, that shows the direction where the e- density is greatest *according to each element's electronegativity.*



1. Determine whether each molecule is a dipole by doing the following steps:
    a. look up the electronegativity number on your chart from Thursday. Write this number next to each atom in your molecule (this step is optional)
    b. draw an arrow to show the dirction of polarity of each bond.
    c. draw a hollow arrow to show the overall polarity of the molecule OR write *nonpolar molecule* below the molecule