CHM 130 Exam IIA Fall 2016 Name: _____KEY_____

Cell phones must be put away. If I see a phone = cheating = 0 on the exam.

Good luck.

1. Complete the electromagnetic spectrum:
   Gamma X ray _____**UV**_____ visible IR ____**microwave**_____ radio

2. As wavelength increases, frequency (increases or **decreases**) and energy (increases or **decreases**). Circle your answers.

3. **True** or False? Electrons orbit the nucleus in discrete energy levels. The electrons must exist on an energy level – they cannot exist in between energy levels.

4. **True** or False? When an electron absorbs heat or electrical energy, it can jump to a higher level. Then when it relaxes and jumps back inwards, it releases a photon of light.

5. Answer the following regarding the sublevels, orbitals, and electrons in an atom.
   a. How many electrons can fit into a d sublevel? _____**10**_____
   b. How many electrons can fit into the 3rd level total? _____**18**_____
   c. How many orbitals are on the second level? _____**4**_____
   d. How many electrons can fit into an orbital? _____**2**_____
6. Write electron configurations for the following atoms and ions:
   a. F^{-1} _____**$1s^2 2s^2 2p^6$**_____
   b. P _____**$1s^2 2s^2 2p^6 3s^2 3p^3$**_____
   c. K^{+1} _____**$1s^2 2s^2 2p^6 3s^2 3p^6$**_____
   d. B _____**$1s^2 2s^2 2p^1$**_____
7. P^{3-} ion is isoelectronic with what atom? _____**argon**_____

8. $^{31}P^{3-}$ ion has _**15**__ protons, __**16**__ neutrons, and _**18**__ electrons. (put numbers in the blanks)

9. Potassium is in this group:]
   a. Alkaline earth metals b. **alkali metals** c. noble gases d. halogens

10. Which atoms is the smallest?
    a. Ga **b. O** c. B d. Se e. At

11. Explain your answer to the previous question and do not quote the trend.

Atoms higher up on the table have their outer electrons in a closer level. So B and O are smaller than the others. Then B is larger than O because B has only 5 protons to pull its second level electrons close while O has 8 protons to pull its second level electrons close. More protons allows O to pull the electrons closer, more positive charge attracts more tightly so O is smaller than B.

12. Why do metals have such low ionization energy compared to nonmetals?

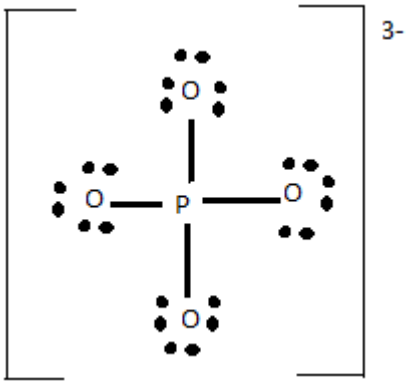
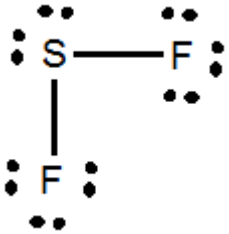
Metals want to lose electrons anyway, so it takes little energy to remove an electron from them. Nonmetals want to gain electrons, so losing one is a bad thing for them thus higher energy. IE is the energy needed to remove one electron from an atom.

13. Which atom has the highest electronegativity?
    a. **F** b. He c. H d. Fr e. Rn

14. True or **False**? Metals tend to gain electrons and form positive cations.

15. True or **False**? When a nonmetal gains electrons it becomes smaller in size.

16. Draw Lewis dot structures in the boxes below for the following molecules / ions.

PO_4^{3-}	SF_2
	

17. The shape of the ion PO_4^{3-} is:
    a. Trigonal planar b. **tetrahedral** c. bent d. trigonal pyramid e. linear

18. The shape of SF_2 is:
    a. Trigonal planar b. tetrahedral c. **bent** d. trigonal pyramid e. linear

19. The molecule SF_2 is polar or nonpolar overall? _____**polar**_____

20. Is the molecule H_2O polar or nonpolar overall? _____**polar**_____

21. Circle the polar bonds in this list: **H-F** **P-O** C-H **Se-Cl** O-O

22. What is the name for the following compounds?

a. $Sr(NO_2)_2$ _____**strontium nitrite**_____

b. MnS_2 _____**manganese (IV) sulfide**_____

c. P_2O_5 _____**diphosphorus pentaoxide**_____

d. Na_3N _____**sodium nitride**_____

e. $Fe_2(SO_4)_3$ _____**iron(III) sulfate**_____

23. What is the formula for the following compounds?

a. Cobalt (III) chloride _____**$CoCl_3$**_____

b. Dihydrogen monoxide _____**H_2O**_____

c. Sodium sulfite _____**Na_2SO_3**_____

d. Magnesium acetate _____**$Mg(C_2H_3O_2)_2$**_____

e. Silicon tetrafluoride _____**SiF_4**_____

24. Give the formula for one of the strong acids: __**HCl or HNO_3 or H_2SO_4**___

25. Arrhenius bases release this ion in water:

a. H^+ b. **OH^-** c. O^{2-} d. H^- e. OH^+

26. In this reaction what is the Brosted Lowry base? NH_3 (aq) + HBr (aq) → NH_4^+(aq) + Br^- (aq)

a. **NH_3** b. HBr c. NH_4^+ d. Br^-

27. Draw HF and KOH in water below in the two beakers:

28. An acidic solution will have a pH of:

a. **Less than 7** b. equal to 7 c. greater than 7

29. Which of the following ionic compounds is insoluble in water?

a. $Ba(OH)_2$ b. **PbF_2** c. NH_4Cl d. $Al(NO_3)_3$ e. SrS

30. Which of the following is a strong electrolyte?

a. **H_2SO_4(aq)** b. $HC_2H_3O_2$(aq) c. AgCl d. CH_4 e. MgS

31. Which of the following are weak electrolytes?

a. Strong bases b. covalent compounds c. **insoluble ionic compounds**

Bonus: True or **False**? When a bond is broken, heat energy is released. **It is required**

Bonus: **True** or False? The bond length for a covalent bond is less than the sum of the two atomic radii.