Chapter 4

1. What are the shape of p sublevels?__dumbell_______ What shape are s orbitals?_sphere
2. Write the electron configuration for Cl.

$1s^2 2s^2 2p^6 3s^2 3p^5$

3. Write the electron configuration for Fe.

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

4. Identify the element:

a. $1s^2 2s^2 2p^6 3s^2 3p^4$ _S____ b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^9$ _Ag____
c. $1s^2 2s^2 2p^6 3s^1$ _Na____

5. Write the orbital diagram for:

a. manganese ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑ ↑ ↑ ↑ ↑

1s 2s 2p 3s 3p 4s 3d

b. silicon ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑ ↑ ___

1s 2s 2p 3s 3p

6. Match the following: Cl, Ar, I, with one of the following statements

a. Which has the highest occupied energy level?___I____
b. Which has five electron in its 3p sublevel?___Cl____
c. Which has its highest energy level filled?___Ar____

7. In the sixth period after Ba what sublevel gets filled with the next 14 elements?__4f__
8. In the fourth period after the first 2 elements what sublevel gets filled?__3d__
9. Which one of the following will have the first pair of electrons in the p sublevel?
Si P S Cl

10. What is the electron configuration for the element with 5 protons?

$1s^2 2s^2 2p^1$

11. As the wavelength of light increase the frequency__decreases_____.
12. How many electrons can occupy the 3rd energy level? __18____
13. How many electrons can occupy the 4th energy level?__32____
14. How many orbitals are in the 3rd energy level?___9___
15. When does an atom emit light?

When an atom jumps from a higher energy level to an lower one.

16. What is the lowest energy state called? Ground state

17. Another name for a quanta or particle of light is called a __photon_____.

18. What color of light has the longest wavelength? _red_______

19. What color of light has the shortest wavelength? __violet______
20. What is the wavelength of an EM wave traveling at the speed of light with a frequency of 300Hz?

3.0×10^8 m/s = ? 300Hz

? = 1.0×10^6

21. What speed do all electromagnetic waves travel at?____ 3.0×10^8 m/s _______

22. Which EM waves have the highest frequencies?__gamma_________
23. Which EM waves have the lowest frequencies?____radio________
24. Electrons entering orbitals of the lowest energy first… follows what principle?___Aufbau_________

25. What must be true for 2 electrons to be in the same orbital? \

They must have opposite spins.

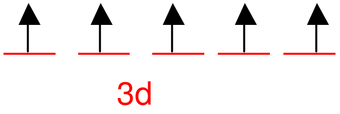
26. How many half filled orbitals are in nitrogen?

3

27. How many unpaired electrons are in Mg?

0

28. If you have 5 electrons to fill a 3d sublevel, how should you draw the orbital diagram?



29. Which has the lowest energy? 4d, 4f, 5s, 5p

30. True or false: When is light given off?

a. When electrons absorb energy.__F_____
b. When protons move. ___F____
c. When electrons return to their normal atomic orbital.___T____
d. When atoms collide.___T____

31. What is the maximum number of oribitals in the d sublevel? _5____

32. Which sublevels are in the 3rd energy level? _______s, p, d__________

33. What is the Pauli exclusion principle?

In order for 2 electrons to both be in the same orbital they must have opposite spins.

34. What is Aufbau's principle?

Electrons fill orbitals from the lowest energy level to the highest energy level.

35. What is Hund's rule?

All orbitals in sublevel each get one electron before any are filled.

Chapter 5

1. Which is the largest atom? Cl Cl^- F^- Ne
2. What is the magic number in chemistry? ___8_____
3. True or False: When an atom becomes an ion it: a. loses electron____F_____ b. remains the same size___F____ c. becomes larger___T_____ d. becomes smaller ___F_____
4. Mg and Ca have the same properties because they have the same __# of valence electrons.
5. How many valence electrons do noble gases have?___8__ How many do alkaline metals have?___2_____ How many do halogens have?___7_______
6. What is the most reactive non-metal?___F__
7. What is the most reactive metal?__Fr___
8. What is the charge for the alkali metals?___-1_____ the alkaline metals?___-2____
9. Give the group name for each element: Ar _noble gases__ Se_oxygen group___

Ca__alkaline metals___ I__Halogens_______

10. Which is a metal? N P As Bi
11. Which metal reacts most with water? Na K Rb Cs

12. What do noble gases not do?

form compounds easily

13. Yes or No. State whether each of the following increases as you go down group 2

a. electron affinity__N____ b. ionization energy__N___ c. number of valence electrons __N____ d. atomic radius__Y___

14. What is an atom's tendency to attract shared electrons? __electronegativity___________
15. Which has the lowest electron affinity? Br Cl Se S
16. Which has the highest electron affinity? Br Cl Se S
17. Which group has the highest electron affinity? _halogens_
    Which has the lowest?_alkali metals______
18. Which has the smallest ionization energy? C N P Si, Rb Ca K Sr

19. The energy required to remove an electron from an atom is called __ionization energy
20. Which element has the smallest atomic radius? a. Be Ca F Cl b. Se Cl Br S
21. Which is the largest? K ion, Br ion, or Ca ion
22. What subatomic particle plays the biggest part in determining physical and chemical properties of elements? electron
23. The periodic table is arranged in order of increasing _atomic number_________.
24. What is another name for semimetal? __metalloids_______
25. Name and define the periodic trends

1 atomic radius—size of an atom. Decreases from bottom left to top right.

2 electron affinity – desire or want for electrons. Increases from bottom left to top right.

3 ionization energy – energy needed to remove an electron from an atom. Increases from bottom left to top right.

4 electronegativity – ability to attract electrons in an atomic bond. Increases from bottom left to top right.

Ch 7&8

1. How many electrons are shared in a polar bond?__2 but unequally_______
2. What is the bond angle in a trigonal planar molecule?__120°_________
3. What are the shape and bond angle for the following?

(You may have to draw some to find out shape)

CH_4 _tetrahedral__109.5°____ BCl_3 _trigonal planar____120°____
O_2 _linear__ 180°_____ NH_3 _pyramidal___ _107°____
H_2S _bent___ _105°____ BeF_2 _linear__ _180°____
HI _linear____ _180°____ H_2O __bent___105°____

4. To account for the shape of molecules we use the __VSEPR_______ theory.
5. State the type of bond that occurs between each pair of elements.

N and C__Polar covalent___ Mg and Cl_ionic____ Li and Cl_ionic___ S and O_polar____
C and C_nonpolar______ H and B__nonpolar_____

6. Yes or No. Which are diatomic molecules?

F_Y___ S_N___ P_N___ Ne_N__ H_Y__ I__Y__

7.

1—ABC 2—A_3B 3—AB_2

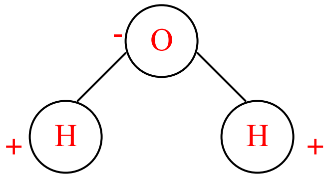
a. Which molecules are polar?__1&3______
b. The arrow points to what end of the dipole?__negative_______ Why? It has the higher electronegativity

8.

a. Which one is tetrahedral?__3__ b.Which is bent?___5____

c. Which is trigonal planar__1___ d. Which is pyramidal?__2_____

12. Draw and label the positive and negative ends of a water molecule.



13. What is true about a carbon dioxide molecule?

a. nonpolar, with nonpolar bonds b. polar, with nonpolar bonds

c. polar, with polar bonds d. nonpolar, with polar bonds

14. What determines the polarity of a bond? Electronegativity difference

15. What determines the polarity of a molecule? Electronegativity difference & shape

16. How many pairs of electrons are in a double covalent bond?__2___

17. What does the structural formula of a molecule tell you? Which atoms are bonded to each other.

18. Which bond is completely nonpolar? H-N O-C F-F F-Cl

19. How many pairs of shared and unshared are in the following?

a. HI __1___ __3___ b. O_2 _2____ __4___ c. H_2O __2___ __2___ d. NH_3 __3___ __1___

20. What is the charge on the cation in Na_2S?___+1___

21. How does an ionic bond work? Attraction between to oppositely charged ions.

22. What would be the Lewis Dot structure for an element with 12 electrons? · Mg ·

23. What is the octet rule? Atoms tend to lose, share, or gain electrons so that they have a complete outer shell of 8 electrons.

24. What happens when oxygen obeys the octet rule?__it gains 2 electrons_______
How about Nitrogen? _gains 3 electrons_______
How about Calcium? __loses 2 electrons______

26. Yes or No. Which of the following have a complete octet?

a. Ba^{2+}__Y__ b. Ca^{+}__N___ c. S^{2-} _Y___ d. Cl^{-}__Y__ e. Al^{3+}__Y___ f. O^{-} __N__

Ch 13

1. Name the variables that change and the variable that stays constant for each law.

	change	constant
a. Charle's Law	_V____, ___T___	__P_____
b. Boyle's Law	__P___, ___V___	_____T___
c. Gay-Lussac's Law	__T___, ___P___	___V____

2. Which is not a unit for measuring pressure? mL of water, mmHg, p.s.i., atm
3. What happens to the pressure of a gas when the temperature remains constant and the volume increases? decreases
4. What happens to the temperature of a gas when the volume remains constant and the pressure decreases? decreases
5. What happens to the volume of a gas when the pressure remains constant and the temperature increases? increases
6. Where is the air pressure greater, at the top of a mountain or at sea level?
7. Define absolute zero. Coldest possible temperature where the particles of a substance stop moving.

8. STP stands for what? Standard temperature and pressure

9. What are the values for STP? 1 atm, 273K

10. What gas law is used when no variable is held constant? Ideal gas law
11. What is the formula for number 10? $PV= nRT$

12. For the combined gas law what is the only variable that doesn't change? Amount of gas.
13. What are the parts of the Kinetic Theory of gases?
1. gases are made of very small particles 2. distance between particles are very large. 3. particles are in constant motion. 4. collisions are perfectly elastic. 5. average kinetic energy is based on temperature. 6. gas particles exert no force on each other.

14. Write the equation relates density to molar mass? $D= MP/RT$

Ch 14

1. Match each phase change with its definition.
a. liquid to solid b. gas to liquid c. gas to solid d. solid to liquid e. solid to gas f. liquid to gas
_b condensation _e_ sublimation __f__vaporization _c_deposition _d__melting _a_freezing

2. What is a unit cell? Smallest repeating pattern which makes a crystal.

3. Describe the shape, volume, and motion of particles for:

solid	definite	definite	vibrate back and forth in fixed posititions
liquid	indefinite	definite	able to slide past one another
gas	indefinite	indefinite	move about freely

4. What is the difference between amorphous and crystalline substances?

Amorphous solids do not have a repeating crystal patern

5. Define viscosity Resistance to a liquid's flow.

6. Does viscosity increase or decrease with an increase in temperature? decrease

7. Define surface tension attractive forces between particles that allow objects of larger density to "float" on liquid.

8. Does surface tension increase or decrease with an increase in strength of intermolecular forces? increase

9. True or false? Water always boils at 100°C. ____false___

10. List the 3 intermolecular forces in order of increasing strength.

disperson, dipole-dipole, hydrogen bonding

11. What is the difference between vaporization and evaporation?

They both are phase changes from liquid to gas, but evaporation occurs below the boiling point.

12. What are 3 unusual properties of water?

Unusually high boiling point. Large heat capacity. High surface tension. Universal solvent.

Ch 15

1.Define solution. Homogeneous mixture that exists in one phase

2. Define solute and solvent solute gets dissolved, solvent does the dissolving

3. Once dissolved, do particles ever fall out of solution? Yes or No. _______
4. Number 3 is one property of a solution. What are the 2 others?

Made from very small particles, and particles are uniformly distributed.

5. What is the definition of molarity? Moles of solute per liters of solution

6. What is the definition of molality? Moles of solute per kilogram of solvent

7. If a solution is saturated you can dissolve more solute in it, true or false?
8. To make a supersaturated solution you first have to make a saturated solution and then heat it up, true or false?
9. Solvation is what? The process of the solvent particles surrounding the solute particles.

10. The amount of solute needed to form a saturated solution in a given amount of solvent is what term? molarity, molality, solubility, soluble, colligative property
11. When you dissolve sugar in water does the boiling point go up or go down?
12. When you dissolve salt in water does the freezing point go up or down?
13. Numbers 11 and 12 are examples of what? Colligative properties
14. When you dissolve a solute in a solvent you change the __physical properties _ of the _solvent__.
15. When you increase the temperature of soda do you increase or decrease the solubility of the gas in the soda?
16. When you increase the temperature of iced T do you increase or decrease the solubility of the sugar in the tea?
17. Nitrogen dissolves easier in blood at high or low pressure?

18. When you shake soda does the gas in it become more or less soluble?

19. What is the solubility of $Ba(OH)_2$ at 76°C? __80g_______
20. At 40°C approximately 106g of $NaNO_3$ dissolves in 100g of water. Describe the solution as saturated, unsaturated, or supersaturated. __________
21. 50g of KCl are placed in 100g of water as the solution cools from 75°C to 60°C. Is the solution saturated, unsaturated, or supersaturated? __________
22. 50g of NaCl are placed in 100g of water at 20°C. How much dissolves?____36g__________

23. How many grams of KI will dissolve in 200g of water at 10°C? ___270g__________

Ch 18&19
1. A solid dissolves in water and feels slippery. Is the solution acidic or basic?
2. Magnesium falls in a solution and dissolves. Is the solution acidic or basic?

3. What is the Arrhenius definition of acid and base?

acid -- A substance when dissolved in water releases H^+ ions.

Base—A substance when dissolved in water realeases OH^- ions.

4. What is the Bronsted-Lowry definition of acid and base?

base-- H^+ acceptor

acid-- H^+ donator

5. Which solution is most basic? $[H^+] = 1 \times 10^{-2}$, $[H^+] = 1 \times 10^{-5}$, $[OH^+] = 1 \times 10^{-2}$

$[OH^+] = 1 \times 10^{-5}$

6. Which solution is most acidic? $[H^+] = 1 \times 10^{-2}$, $[H^+] = 1 \times 10^{-5}$, $[OH^+] = 1 \times 10^{-2}$

$[OH^+] = 1 \times 10^{-5}$

7. Which pH is most acidic? 1 5 7 9 11

8. Which pH is most basic? 1 5 7 9 11

9. Concentrations of acid and base solutions are measured by what value?

Molality, molarity, or mole fraction

PROBLEMS

1. 738 mmHg = _____ atm

$$738 \text{ mmHg} \times \frac{1 \text{ atm}}{760 \text{ mmHg}} = 0.971 \text{ atm}$$

2. A large balloon contains 5.00L of carbon dioxide at 27.0°C. Determine the actual volume of CO_2 in the balloon under standard conditions and assume the pressure remains constant.

Charle's law $$\frac{5.00L}{300K} = \frac{V_2}{273K} \qquad V_2 = 4.55L$$

3. A balloon has a volume of 810mL at a pressure of 750 torr and a temperature of -77°C. The balloon is removed from this temperature and allowed to warm to room temperature, 25°C, in a pressure chamber of 3.00 atm. Calculate the final volume of the balloon.

Combined gas law $$\frac{750 \text{ torr} \times 810mL}{196K} = \frac{2280 \text{ torr} \times V_2}{298K} \qquad V_2 = 405mL$$

4. Calculate how many moles of CH_4 are in a sealed 800mL flask at 22°C and 780mmHg of pressure.

Ideal gas law $1.03\text{atm x }.800\text{L} = \text{n } 0.0821\frac{\text{L}\cdot\text{ atm}}{\text{mol}\cdot\text{ K}}\text{ x }295\text{K}$ n= .034 mol

5. What pressure is exerted by 0.625 mole of a gas in a 45.4L container at –24.0°C?

ideal gas law $\text{P x }45.4\text{L} = 0.625\text{ mol } 0.0821\frac{\text{L}\cdot\text{ atm}}{\text{mol}\cdot\text{ K}}\ 249\text{ K}$ P = 0.28atm

6. What is the molarity of a solution formed by mixing 10.0g of NaOH with enough water to make 100mL of solution?

$\frac{0.25\text{mol}}{0.100\text{L}} = 2.5\text{M}$

7. How many grams of potassium chromate, $KCrO_4$, are needed to make 250mL of a 0.250M solution? $0.250\text{M} = \frac{\text{mol}}{0.250\text{L}}$ $0.0625\text{mol x }\frac{155.1\text{g}}{1\text{ mol}} = 9.69\text{g}$

8. What is the molality of a solution made up of 16.1g of Cl_2 dissolved in 5000g of water?

$\frac{0.227\text{mol}}{5.000\text{Kg}} = .0454\text{m}$

9. What is the hydronium ion concentration and the pH of an aqueous solution that has a hydroxide concentration of $6.4 \text{ x}10^{-11}$?

$1.0 \text{ x}10^{-14} = [H_3O^+]\ 6.4 \text{ x}10^{-11}$ $[H_3O^+] = 1.56 \text{ x}10^{-4}$

$\text{pH} = -\log 1.56 \text{ x}10^{-4}$ pH = 3.8