HONORS **Chemical Bonds** and the **Chemical Reactions** Study Guide KEY

Complete the following problems to help prepare for the test.

Objective 1: Students will know ionic and covalent bonding.

1. Which subatomic particle allows chemical bonding to occur?
   Valence Electrons
2. What are the differences between ionic and covalent bonding?

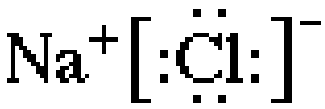
Ionic Bonds	Covalent Bonds
form between metals and nonmetals	**form between nonmetals**
give or take valence electrons	**share valence electrons**

3. What **type** of bonds do the following compounds have:
   - Fe_2O_3 **Ionic Bond**
   - CH_4 **Covalent Bond**
   - Mg_2 **Metallic Bond**

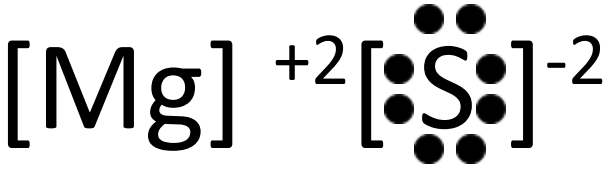
4. Give the definition for the following types of bonds (include what elements the bond is between and what happens to the electrons):
   - Ionic Bond – **between a metal and a nonmetal, atoms give up or take valence electrons**
   - Covalent Bond – **between two nonmetals, atoms share valence electrons**
   - Metallic Bond - **metals share a sea of electrons**

5. Draw bonding structures for the following compounds and molecules
   - NH_3

   - NaCl



   - MgS

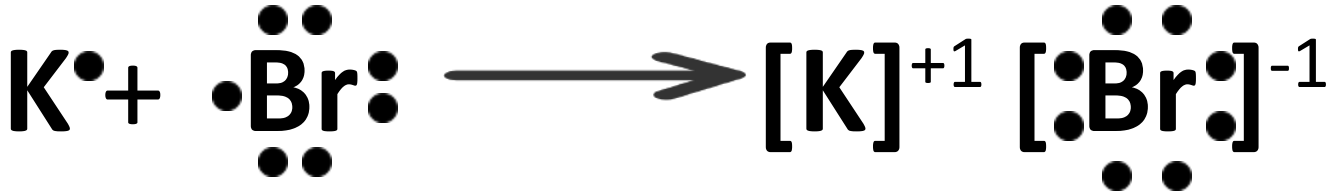


- HCl

6. Draw the Chemical Bonding Diagram (Lewis Dot Diagram) for the bond that occurs between Hydrogen and Chlorine to produce Hydrochloric Acid (HCl) Also, give an explanation of everything you can about the type of **bonding** and what is happening with the electrons.

Covalent bond since it is between two nonmetals, hydrogen wants to have 2 valence electrons, chlorine wants to have 8 valence electrons, and the two atoms share each other's valence electrons in order to achieve this.

7. Draw the Chemical Bonding Diagram (Lewis Dot Diagram) for the bond that occurs between Potassium and Bromine to produce Potassium Bromide (KBr) Also, give an explanation of everything you can about the type of **bonding** and what is happening with the electrons.



Ionic bond since potassium is a metal and bromine is a nonmetal, potassium and bromine would each like to have 8 valence electrons, bromine is going to take potassium's 1, however, because in ionic bonds, the nonmetal always steals electrons from the metal. After bromine takes potassium's 1 valence electron, each element's atom changes charge. Since potassium got rid of an electron, it has a +1 charge and bromine gained an extra electron so it has a -1 charge overall.

Objective 2: Students will understand The Law of Conservation of Mass and why balancing chemical equations is important because of the law.

1. What does the law of conservation of mass state?
   Matter cannot be created or destroyed

2. A student has measured out 400 mL of water and placed it in a beaker on top of a Bunsen burner. The water has a mass of 400g. While waiting for the water to boil he sits down and begins working on his science questions. He becomes so caught up in his work that 30 minutes has passed. He removes the beaker from the Bunsen burner with his tongs and notices that much of the water has "disappeared"; he is confused until he remembers something his teacher told him… *Matter cannot be created or destroyed.* He begins to think – where has it gone? Help this student – where has the water gone? Explain using the law of conservation of mass.
   The water evaporated into the air as it was boiling

3. Balance the following chemical equations

   _____ P_4 + **__5__** O_2 → **__2__** P_2O_5

   __2__ K + _____ Br_2 → **__2__** KBr

   __2__ Al + **__3__** FeO → _____ Al_2O_3 + **__3__** Fe

   _____ $C_{10}H_{16}$ + **__8__** Cl_2 → **__10__** C + **__16__** HCl

   _____ Zn + **__2__** HCl → _____ $ZnCl_2$ + _____ H_2

   _____ $Fe_2(SO_4)_3$ + **__6__** KOH → **__3__** K_2SO_4 + **__2__** $Fe(OH)_3$

   _____ NO_3 + _____ SO_4 → _____ K + _____ NOS **impossible**

4. When balancing chemical equations explain what can be changed and why as well as what cannot be changed and why.
   Coefficients can be changed because that does not change the chemical formula - it only adds a new quanitity of the entire compound. Subscripts cannot be changed because that will change the chemical formula and therefore change the substance.

5. Explain why it is necessary to balance chemical equations?
   Since matter cannot be created or destroyed, according to the law of conservation of mass, the same number of atoms for each element going into the chemical reaction (the reactants) must be the same as the number of atoms for each element that come out of the chemical reaction (the products).

Objective 3: Students will know the evidence that a chemical reaction has occurred and will know whether it is an endothermic or exothermic reaction.

1. Does an endothermic reaction require or give off heat? **requires heat (heat is absorbed in the chemical reaction)**

2. What happens to the surrounding air temperature when an endothermic reaction takes place?
   surroundings get cooler

3. Does an exothermic reaction require or give off heat? **gives off heat (heat is released in the chemical reaction)**

4. What happens to the surrounding air temperature when an exothermic reaction takes place?
   surroundings get warmer

5. List the five pieces of evidence that a chemical reaction has taken place.
   - **Gas bubbles**
   - **Change in temperature**
   - **Change in color**
   - **Formation of a precipitate**
   - **Odor**

From the following list,state which are examples of evidence of chemical reactions and which ones are not examples of evidence of chemical reactions.

6. Burning toast in the toaster **chemical reaction**
7. Chopping up firewood **not a chemical reaction**
8. Mixing red and blue paint together in order to get purple **not a chemical reaction**
9. Blowing bubbles through a straw in a glass of chocolate milk **not a chemical reaction**
10. Crystals forming when making rock candy **chemical reaction**
11. Adding ice cubes to hot chocolate so it cools down faster **not a chemical reaction**
12. The smell that is given off from a stink bomb **chemical reaction**

Using the 5 indicators of chemical reactions explain how you can determine whether a chemical reaction has taken place or not in the scenario below:

13. A scientist poured chemical X, which is a clear liquid into a beaker with chemical Y, which is a yellow liquid and waited approximately 15 seconds. At the end of the 15 seconds, the liquid in the beaker turned bright orange and the beaker was cool to touch. A chemical reaction had taken place.
    there is a color change after the reaction took place
    there is a change in the temperature after the reaction took place

Classify each of the following reactions as either exothermic or endothermic.

14. $2CH_3COOH + Na_2CO_3 + \text{Energy} \rightarrow 2CH_3COONa + H_2O + CO_2$ **endothermic (because heat is being absorbed in the chemical reaction)**

15. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O + \text{Energy}$ **exothermic (because heat is being released from the chemical reaction)**

Decide whether each of these reactions is exothermic or endothermic:

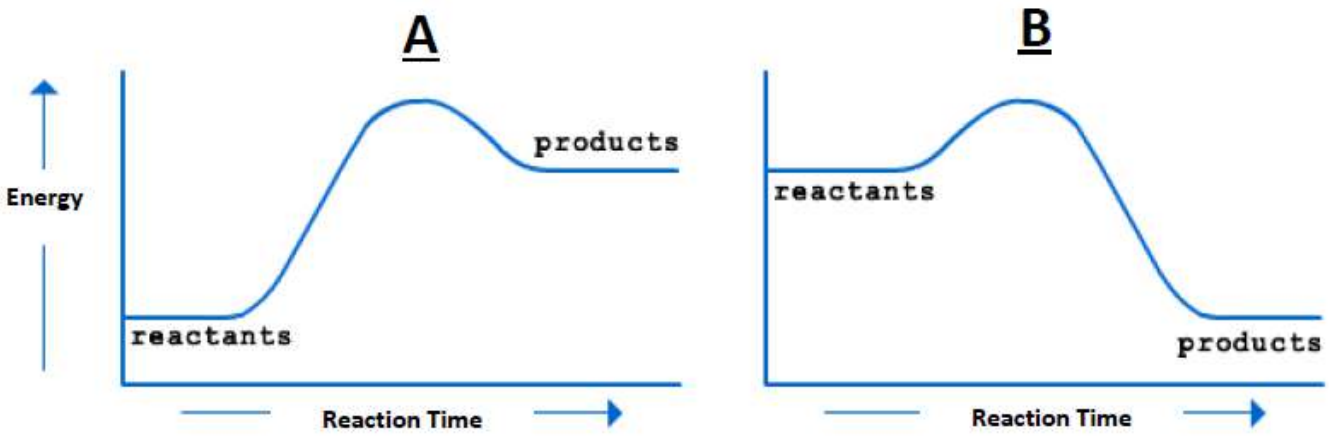
16. *When two chemicals mix their temperature rises:* ***endothermic***
17. *A solid burns brightly and releases heat, light and sound:* ***exothermic***
18. *When two chemicals are mixed their temperature drops:* ***exothermic***
19. *Plants take in light energy for photosynthesis:* ***endothermic***
20. *Evaporation:* ***endothermic***
21. *The combustion reaction in a car engine:* ***exothermic***
22. *Digestion of food:* ***exothermic***
23. *Condensation:* ***exothermic***

24. Draw an endothermic reaction graph. Label the reactants, products, x axis, y axis. Give a brief explanation of the exchange of heat (is it being absorbed or released). State whether the surrounding get cooler or warmer when this type of reaction occurs. **Heat is being absorbed in this reaction. The surroundings get cooler during this type of reaction.**

See Graph A below.

25. Draw an exothermic reaction graph. Label the reactants, products, x axis, y axis. Give a brief explanation of the exchange of heat (is it being absorbed or released). State whether the surrounding get cooler or warmer when this type of reaction occurs. **Heat is being released in this reaction. The surroundings get warmer during this type of reaction.**

See Graph B below.



26. Give an example of a time when there is evidence that a chemical reaction has occurred, but a chemical reaction has not actually taken place.

27. Give an actual example of when the same type of evidence is actually caused by a chemical reaction.

Objective 4: Students will know the different types of chemical reactions by looking at a chemical equation.

1. Explain what happens during each type of chemical reaction.
   - Synthesis- **two or more compounds become one**
   - Combustion- **oxygen is a reactant, water and carbon dioxide are products**
   - Decomposition- **one compound becomes two or more**
   - Single displacement- **one switch occurs**
   - Double displacement- **two switches occur**
2. State what type of chemical reaction each of the following equations show.
   - $C_{10}H_8 + 12\ O_2 \rightarrow 10\ CO_2 + 4\ H_2O$

     combustion
   - $8\ Fe + S_8 \rightarrow 8\ FeS$

     synthesis
   - $2\ H_2O \rightarrow 2\ H_2 + O_2$

     decomposition
   - $Mg + 2\ H_2O \rightarrow Mg(OH)_2 + H_2$

     single displacement
   - $Pb(NO_3)_2 + 2\ KI \rightarrow PbI_2 + 2\ KNO_3$

     double displacement
   - $NaOH + KNO_3 \rightarrow NaNO_3 + KOH$

     double displacement
   - $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

     combustion
   - $2\ Fe + 6\ NaBr \rightarrow 2\ FeBr_3 + 6\ Na$

     single displacement
   - $CaSO_4 + Mg(OH)_2 \rightarrow Ca(OH)_2 + MgSO_4$

     double displacement
   - $Pb + O_2 \rightarrow PbO_2$

     synthesis
   - $Na_2CO_3 \rightarrow Na_2O + CO_2$

     decomposition

Objective 5: Students will be able to name chemical compounds according to appropriate nomenclature.

1. Write out some simple rules/directions on how to name each of the different type of compounds.
   - Binary Ionic

     if made up of only 2 elements (1metal, 1 nonmetal), list out metal as it is on the PT, list out the nonmetal, but change its ending to "ide"

   - Polyatomic Ionic

     if made up of more than 2 elements (often times has parenthesis, made of metals and nonmetals), if polyatomic ion is first, list it out as is then list the nonmetal with the "ide" ending. If the polyatomic ion is last, list out the metal as it is on the PT and then list the polyatomic ion.

   - Covalent

     made up two nonmetals, list out the first nonmetal and add a prefix to it depending upon the number of atoms that element has (if there is only one, do not add the prefix of "mono"), list out the second nonmetal with the "ide" ending and add its prefix depending upon how many atoms of that element there are.

2. Tell what type of compound each of the following are (binary ionic, polyatomic ionic, or covalent) **AND** give their name.

Chemical Formula	Type of Compound	Chemical Name
P_4S_5	covalent	tetraphosphorus pentasulfide
NaOH	polyatomic ionic	sodium hydroxide
SeF_6	covalent	selenium hexafluoride
KBr	binary ionic	potassium bromide
Be_2SO_4	polyatomic ionic	beryllium sulfate
CuO	binary ionic	copper oxide
$Be(C_2H_3O_2)_2$	polyatomic ionic	beryllium acetate
SCl_4	covalent	sulfur tetrachloride
GaN	binary ionic	gallium nitride
Al_2S_3	binary ionic	aluminum sulfide
$V_3(PO_4)_5$	polyatomic ionic	vanadium phosphate
Na_2CO_3	polyatomic ionic	sodium carbonate
NF_3	covalent	nitrogen trifluoride
$SbBr_3$	covalent	antimony tribromide
$Mg(NO_3)_2$	covalent	magnesium nitrate