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

Below are the expectations for each point level for the two Chemical Bonds and Reactions objectives.

Objective 1: Students will know the different types of bonding.

1 point – (Basic)

- Know which subatomic particle allows bonding to occur.
- Know the definition of each of the types of bonds we learned about in class.

2 points – (Developing)

Skills from the 1 point question plus:

- When given a chemical formula, be able to identify whether the compound/molecule has ionic, covalent, or metallic bonds.

3 points – (Proficient)

Skills from the 1 and 2 point questions plus:

- When given a chemical formula, be able to properly draw the chemical bonding of the elements.

4 points – (Exemplary)

Skills from the 1, 2, and 3 point questions plus:

- When given a chemical formula, be able to properly explain the exchange of electrons that is taken place.

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

1 point – (Basic)

- Be able to write the Law of Conservation of Mass.
- Using the Law of Conservation of Mass, be able to determine the mass of the products when the mass of the reactants are given **OR** be able to determine the mass of one of the reactants when the mass of the products and other reactants are given.

2 points – (Developing)

Skills from the 1 point question plus:

- Be able to balance a simple chemical equation.

3 points – (Proficient)

Skills from the 1 and 2 point questions plus:

- Be able to balance a more complex chemical equation.

4 points – (Exemplary)

Skills from the 1, 2, and 3 point questions plus:

- Be able to balance a more complex chemical equation and explain what is happening with the reaction according to the Law of Conservation of Mass.
- Be able to explain the purpose behind changing coefficients and why you cannot change subscripts.

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 point – (Basic)

- Be able to classify a chemical equation as either endothermic or exothermic.
- Be able to list three pieces of evidence that a chemical reaction has occurred.

2 points – (Developing)

Skills from the 1 point question plus:

- Be able to list out the 5 different pieces of evidence that a chemical reaction has occurred.

3 points – (Proficient)

Skills from the 1 and 2 point questions plus:

- When given real life examples of chemical reactions be able to classify it as an exothermic reaction and an endothermic reaction.
- Be able to answer questions on the evidence that a chemical reaction has or has not taken place when given a scenario..

4 points – (Exemplary)

Skills from the 1, 2, and 3 point questions plus:

- Give an example of a situation where a chemical reaction has NOT taken place but it appears as though a chemical reaction has taken place (has one of the five indicators of chemical reaction).
- Give an example of when you are able to determine a chemical reaction has taken place based on the 5 indicators of chemical reactions.
- Draw and label a graph showing the transfer of energy (heat) be able to identify the graph showing an endothermic reaction and exothermic reaction.
- Know what happens to the heat energy transfer in an endothermic and exothermic reaction.
- Be able to determine what happens to the temperature of the surroundings during an endothermic and exothermic reaction.

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

1 point – (Basic)

- Be able to identify the types of chemical reactions when looking at chemical formulas (pick out 1 equation)

2 points – (Developing)

Skills from the 1 point question plus:

- Be able to identify the types of chemical reactions when looking at chemical formulas (identify all 5, matching)

3 points – (Proficient)

Skills from the 1 and 2 point questions plus:

- Be able to identify the types of chemical reactions when looking at chemical formulas (identify all 5, there are 8 equations to choose from)
- Be able to identify the types of chemical reactions and explain what is happening in each type.

4 points – (Exemplary)

Skills from the 1, 2, and 3 point questions plus:

- Be able to identify chemical reactions and provide an explanation as to why it is that type of reaction.

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

1 point – (Basic)

- Be able to match three compounds to their appropriate names (know how to name ionic binary, ionic polyatomic, and covalent compounds)

2 points – (Developing)

Skills from the 1 point question plus:

- Know the rules for naming ionic binary, ionic polyatomic, and covalent compounds

3 points – (Proficient)

Skills from the 1 and 2 point questions plus:

- Be able to match many compounds to their appropriate names (know how to name ionic binary, ionic polyatomic, and covalent compounds)
- Be able to name ionic binary, ionic polyatomic and covalent compounds on your own.

4 points – (Exemplary)

Skills from the 1, 2, and 3 point questions plus:

- **Be able to identify the type of compound when given a chemical formula.**
- **Be able to properly name the chemical compound when given the chemical formula.**

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?

2. What are the differences between ionic and covalent bonding?

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

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 –
   - Covalent Bond –
   - Metallic Bond -

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.

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.

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?

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.

3. Balance the following chemical equations

_____ P_4 + _____ O_2 → _____ P_2O_5

_____ K + _____ Br_2 → _____ KBr

_____ Al + _____ FeO → _____ Al_2O_3 + _____ Fe

_____ $C_{10}H_{16}$ + _____ Cl_2 → _____ C + _____ HCl

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

_____ $Fe_2(SO_4)_3$ + _____ KOH → _____ K_2SO_4 + _____ $Fe(OH)_3$

_____ NO_3 + _____ SO_4 → _____ K + _____ NOS

4. When balancing chemical equations explain what can be changed and why as well as what cannot be changed and why.

5. Explain why it is necessary to balance chemical equations?

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?

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

3. Does an exothermic reaction require or give off heat?

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

5. List the five pieces of evidence that a chemical reaction has taken place.

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
7. Chopping up fire wood
8. Mixing red and blue paint together in order to get purple
9. Blowing bubbles through a straw in a glass of chocolate milk
10. Crystals forming when making rock candy
11. Adding ice cubes to hot chocolate so it cools down faster
12. The smell that is given off from a stink bomb

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.

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

14. $2CH_3COOH + Na_2CO_3 + \text{Energy} \rightarrow 2CH_3COONa + H_2O + CO_2$

15. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O + \text{Energy}$

Decide whether each of these reactions is exothermic or endothermic:

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

24. Draw an endothermic reaction graph. Label the reactants, products, x axis, y axis. Give a brief explanation of the exchange of heat between the chemical reaction and the surroundings.

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.

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
    - Combustion
    - Decomposition
    - Single displacement
    - Double displacement

2. State what type of chemical reaction each of the following equations show.
    - $C_{10}H_8 + 12\ O_2 \text{ ---> } 10\ CO_2 + 4\ H_2O$
    - $8\ Fe + S_8 \text{ ---> } 8\ FeS$
    - $2\ H_2O \text{ ---> } 2\ H_2 + O_2$
    - $Mg + 2\ H_2O \text{ ---> } Mg(OH)_2 + H_2$
    - $Pb(NO_3)_2 + 2\ KI \text{ ---> } PbI_2 + 2\ KNO_3$
    - $NaOH + KNO_3 \text{ --> } NaNO_3 + KOH$
    - $CH_4 + 2\ O_2 \text{ --> } CO_2 + 2\ H_2O$
    - $2\ Fe + 6\ NaBr \text{ --> } 2\ FeBr_3 + 6\ Na$
    - $CaSO_4 + Mg(OH)_2 \text{ --> } Ca(OH)_2 + MgSO_4$
    - $Pb + O_2 \text{ --> } PbO_2$
    - $Na_2CO_3 \text{ --> } Na_2O + CO_2$

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
   - Polyatomic Ionic
   - Covalent

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		
NaOH		
SeF_6		
KBr		
Be_2SO_4		
CuO		
$Be(C_2H_3O_2)_2$		
SCl_4		
SCl_4		
GaN		
Al_2S_3		
Al_2S_3		
$V_3(PO_4)_5$		
Na_2CO_3		
NF_3		
$SbBr_3$		
$Mg(NO_3)_2$		