Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chemistry Unit 8 – Basic Chemical Reactions**

Chemistry Daily Journal

|  |  |  |
| --- | --- | --- |
| Today’s Date | What do I need to accomplish today? | What do I need to finish up at home? |
|  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Objective | Learning Opportunities | Suggested Due Date | Date Completed |
| 8.1 Identify the parts of a chemical equation. | * Read p. 321 – 323 * Podcast 7.1 – Chemical Reactions * #1, p. 324 and #7, p. 329 * Keeping Track of Atoms * Word Equations | 01/08 |  |
| 8.2 Classify reactions as one of four basic types of reaction, or as a special type of reaction (Combustion, Redox, or Acid-Base) | * Read p. 330 – 341\* Especially Figure 11.10 * Podcast 7.2A – The Basic 4 Types * Types of Reaction Demonstrations * # 22, 23, 25, and 27 pg. 339 * Combustion Day Demos * Classifying Reactions Quiz | 01/09 |  |
| 8.3 Balance Chemical Equations. | * Read p. 324 – 327 \*Especially “Rules for Writing and Balancing Equations” * Podcast 7.3 Balancing Equations * Balancing Equations Quiz 01/13-14 * Law of Conservation of Mass Demos * More Balancing Problems * #3, 4 pg. 327. #5-6 pg. 328, #8-12 pg. 329 * Chemical Equations – Balancing Equations * Unit 8 Test 01/16 | 01/16 |  |

**Unit 8 - Chemical Reactions and Balancing Equations:**

**Learning Goals:**

1. Identify the parts of a chemical equation and Recognize, analyze, interpret, and balance chemical equations (synthesis/combination, decomposition, single and double replacement reactions, and combustion.)
2. Classify reactions as one of four basic types of reaction, or as a special type of reaction (Combustion, Redox, or Acid-Base)

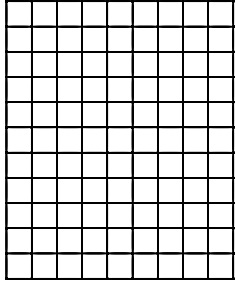
1. Balance Chemical Equations as a way to prove the Law of Conservation of Mass.

**SCALES**

**5 – SWBAT** Classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement, in addition to the special reactions of acid/base, redox, or combustion. Identify parts of a chemical equation. Describe the action of a catalyst. Write skeleton equations, chemical sentences, and balanced chemical equations to describe both simple and complex reactions to fulfill the Law of Conservation of Mass (LOCM). Use half-reactions to balance complex redox reactions.

**4 – SWBAT** Classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement, in addition to the special reactions of acid/base, redox, or combustion. Identify parts and symbols used in a chemical equation. Write skeleton equations, chemical sentences, and balanced chemical equations to describe both simple and complex reactions to fulfill the Law of Conservation of Mass (LOCM).

**3 – SWBAT** Classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement, or combustion. Identify parts and symbols used in a chemical equation. Write skeleton equations, chemicals sentences, and balanced chemical equations to describe reactions to fulfill the Law of Conservation of Mass (LOCM).



**5 -**

**4 -**

**3 -**

**2 -**

**1 -**

**2 – SWBAT** Classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement. Identify parts and symbols used in a chemical equation. Write skeleton equations and balanced chemical equations to describe reactions to fulfill the Law of Conservation of Mass (LOCM).

**1 –** **With help,** **SWBAT** classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement. Identify parts and symbols used in a chemical equation. Write skeleton equations and balanced chemical equations to describe reactions to fulfill the Law of Conservation of Mass (LOCM).

**0 –** With help, student is not able to classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement. Identify parts and symbols used in a chemical equation. Write skeleton equations and balanced chemical equations to describe reactions to fulfill the Law of Conservation of Mass (LOCM)

**Podcast 7.1: Chemical Reactions**

Describing Chemical Reactions

Chemical Reactions occur every day all the time

**[](http://www.google.com/imgres?q=chemical+reaction+cartoon&hl=en&biw=1280&bih=626&tbm=isch&tbnid=Xs48AjssA0NboM:&imgrefurl=http://www.cartoonstock.com/directory/b/bunsen.asp&docid=8Ngkw2yFDDq1pM&imgurl=http://www.cartoonstock.com/newscartoons/cartoonists/ena/lowres/enan208l.jpg&w=400&h=306&ei=Z_slT7D4C-3FsQLI-vWMAg&zoom=1)**Examples:

1.

2.

3.

4.

Evidence of Chemical Reactions

[](http://www.google.com/imgres?q=chemical+reaction&hl=en&sa=X&biw=1280&bih=626&tbm=isch&prmd=imvns&tbnid=5POrzEJqv4iz3M:&imgrefurl=http://worldschemical.blogspot.com/2009/09/chemical-reaction.html&docid=Ky06Lg07Juc73M&imgurl=http://1.bp.blogspot.com/_u0eCgw8i5-Q/Sp2XlR68PaI/AAAAAAAAAJ0/VJZRvVI77_8/s400/T046403A.jpg&w=260&h=340&ei=UvolT4O4JIqvsALLq9GMAg&zoom=1)1.

2.

3.

4.

5.

Chemical Equations: A representation of a chemical reaction

Example:

Reactants =

[](http://www.google.com/imgres?q=chemical+reaction&hl=en&sa=X&biw=1280&bih=626&tbm=isch&prmd=imvns&tbnid=SJh7LHEe4X2i1M:&imgrefurl=http://www.chem4kids.com/files/react_intro.html&docid=21ZN4FgmMxH8gM&imgurl=http://www.chem4kids.com/files/art/reaction_intro_1_240.jpg&w=240&h=240&ei=UvolT4O4JIqvsALLq9GMAg&zoom=1&iact=rc&dur=4&sig=100589134771528297347&page=1&tbnh=123&tbnw=124&start=0&ndsp=21&ved=1t:429,r:1,s:0&tx=41&ty=48)Products =

🡪 =

Chemical Sentences: Names of elements or compounds are used to indicate substances and the amounts used in a reaction.

Example:

Chemical Sentence

Word Equations: Names of elements or compounds are used to indicate substances and the amounts used in a reaction

Example:

Word Equation

Example

Fe(s) + O2(g) → Fe2O3(s)

What are the products?

What are the reactants?

What is the chemical sentence?

What is the word equation?

Other Symbols to know…

(s) = substance is in a \_\_\_\_\_\_\_\_\_\_\_\_ state

(l) = substance is in a \_\_\_\_\_\_\_\_\_\_ state

(aq) = aqueous solution - substance is \_\_\_\_\_\_\_\_\_\_\_\_\_ in water

(g) = substance is in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ state

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = used to separate two reactants or two products

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = separates reactants from products

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = for reversible reactions

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = indicate that heat is used in the reaction

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = A formula (could be any – in this case platinum) indicates it is used as a catalyst

Catalyst: A substance that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a chemical reaction but is not used in the reaction

Example:

Fe(s) + O2(g) Fe2O3(s)

What are the catalysts in this reaction? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What phase state is each substance in for this reaction?

Fe= O2 = Fe2O3 =

Writing Chemical Equations:

Reactants → Products

Word Equations

Chemical Equations

Law of Conservation of Matter: Matter Cannot be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a Chemical or Physical Process.

Balanced Equations – both sides of the equation must have the same number of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for each element

\*\*only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ may be adjusted to balance an equation, NEVER change the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which identify the substance itself

Examples

C(s) + O2(g) → CO2(g)

Fe(s) + S8(s) 🡪 FeS (s)

\*\*Look out for BrINClHOF elements! They are diatomic in their **pure** form.

\*\*You can change the Quantity, but not the Identity of a substance!

**Keeping Track of Atoms**

*Before looking at the equations, determine the number of atoms of each element in the following compounds.*

1. CaCO3 = \_\_\_\_\_Ca, \_\_\_\_\_C, \_\_\_\_\_O
2. Ba(NO3)2 = \_\_\_\_Ba, \_\_\_\_N, \_\_\_\_O
3. 4 Mg(OH)2 = \_\_\_\_Mg, \_\_\_\_O, \_\_\_\_H
4. 3 H2 = \_\_\_\_H
5. (NH4)2SO4 = \_\_\_\_N, \_\_\_\_H, \_\_\_\_S, \_\_\_\_O

*Determine which substances are REACTANTS, which are PRODUCTS, and the meaning of any symbols used in the following equations.*

1. 2 Na(*s*) + 2 H2O (*l*) 2 NaOH (*aq*) + H2 (*g*)
2. 4 NH3 (*g*) + 6NO (*g*) 🡪 5 N2 (*g)* + 6 H2O (*l*)
3. NaCl (*s*) + F2 (*g*) NaF (*s*) + Cl2 *(g)*
4. 3 NaBr (*s*) + H3PO4 (*aq*) 🡪 2 HBr (*aq)* + Na3PO4 (*aq)*

|  |  |  |
| --- | --- | --- |
| **Reactants** | **Products** | **Symbols** |
| 6. |  |  |
| 7. |  |  |
| 8. |  |  |
| 9. |  |  |

*For each of the following, show the number of each type of atom on each side of the reaction. This is called an* **ATOM INVENTORY***. Decide if the chemical equation is balanced or not. You do NOT need to balance these equations!*

1. 2 Na + 2 H2O 🡪 2 NaOH + H2

\_\_\_\_\_\_\_\_\_\_\_ Na \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ H \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ O \_\_\_\_\_\_\_\_\_\_\_ Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. 4 NH3 + 6NO 🡪 5 N2 + 6 H2O

\_\_\_\_\_\_\_\_\_\_\_ N \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ H \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ O \_\_\_\_\_\_\_\_\_\_\_ Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. NaCl + F2 🡪 NaF + Cl2

\_\_\_\_\_\_\_\_\_\_\_ Na \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ Cl \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ F \_\_\_\_\_\_\_\_\_\_\_ Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. 3 NaBr + H3PO4 🡪 2 HBr + Na3PO4

\_\_\_\_\_\_\_\_\_\_\_ Na \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ Br \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ H \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ P \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ O \_\_\_\_\_\_\_\_\_\_\_ Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

WORD EQUATIONS: Translate the following chemical sentences into balanced chemical equations. HINT\* Pay attention to diatomic elements (Br I N Cl H O F)

1. Two molecules of hydrogen plus one molecule of oxygen yields two molecules of water.
2. One molecule of nitrogen plus three molecules of hydrogen yields two molecules of ammonia (NH3)
3. Two molecules of aluminum bromide plus three molecules of chlorine yields two molecules of aluminum chloride and three molecules of bromine.
4. One molecule of hydrochloric acid plus one molecule of sodium hydroxide yields one molecule of sodium chloride plus one molecule of water.
5. One atom of Iron plus one molecule of lead (II) sulfate react forming one molecule of iron (II) sulfate plus one atom of lead.
6. Two molecules of potassium chlorate when heated produces two molecules of potassium chloride plus three molecules of oxygen.
7. One molecule of sulfuric acid decomposes to form one molecule of sulfur trioxide gas plus one molecule of water.
8. One molecule sodium oxide combines with one molecule of water to make two molecules of sodium hydroxide.
9. Two molecules of potassium iodide reacts with one molecule of bromine forming two molecules of potassium bromide plus one molecule of iodine.
10. Two molecules of sodium phosphate reacts with three molecules of calcium nitrate to produce six molecules of sodium nitrate plus one molecule of calcium phosphate.

**Podcast 7.2 A: The "Basic 4" Reactions**



**Synthesis or Combination:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ substances combine to form a single compound

* There is only a single product
* Red Flag: Usually just see elements as the reactants and only \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_
* Examples:

Analogy: (Sketch story below)

Example: The combination of iron and sulfur to form iron (II) sulfide

**Decomposition:** A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compound breaks down into two or more products

* Opposite of Synthesis or Combination
* **Red Flag**: There is only \_\_\_\_\_\_\_\_\_\_\_\_ compound as your reactant.
* Examples:
  + PbO2 🡪
  + HI 🡪
  + NaCl 🡪
  + CaCO3 🡪

Analogy: (Sketch Story Below)

Example: The electrolysis of water to make oxygen and hydrogen gas:

**Single-Replacement:** Atoms of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ replacement atoms of a second element in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **Red Flag**: A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Element is reacting with a Compound
* Sometimes they work, and sometimes there is no reaction!
  + Have to use \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ of Metals to find out! Metals that are more reactive replace metals that are less reactive
  + For Nonmetals it is based on their location on the periodic table (Reactivity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as you move down the column)

Analogy: (Sketch Story Below)

Example: Aluminum replaces Zinc in Zinc (II) chloride to make Aluminum chloride and Zinc

Using the Activity Series of Metals Examples:

* + Mg + Zn(NO3)2 🡪
  + Mg + LiNO3 🡪
  + Cl2 + NaBr 🡪
  + Br2 + BeF2 🡪
  + K + AlPO4 🡪

**Double Replacement:** An exchange of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ between two reacting compounds

* **Red Flag**: Two \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the reactants
* One of three conditions must be met as the products are formed:

Examples:

* + HCl + NaOH 🡪
  + BaCl2 + K2CO3 🡪

Analogy: (Sketch Story Below)

Example: Reaction of lead nitrate with potassium iodide to form lead iodide and potassium nitrate:

Identifying Reaction Types: Identify what type the following reactions are:

* 1. NaOH + KNO3 🠦 NaNO3 + KOH
  2. CH4 + 2 O2 🠦 CO2 + 2 H2O
  3. 2 Fe + 6 NaBr 🠦 2 FeBr3 + 6 Na
  4. CaSO4 + Mg(OH)2 🠦 Ca(OH)2 + MgSO4
  5. Pb + O2 🠦 PbO2
  6. Na2CO3 🠦 Na2O + CO2

**OPTIONAL\*\*\*Podcast 7.2 B: Special Types of Reactions – Acid-Base Reactions, Combustion Reactions, and Redox Reactions**

Acid-Base Reactions: A reaction that involves an Acid and a Base as reactants that will always produce \_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_\_\_\_ as Products.

* + Chemical Formulas for Acids will begin with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (H2SO4 – Sulfuric Acid)
  + Chemical Formulas for Bases will end with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (KOH – Potassium Hydroxide)
  + Acid-Base Reaction is a specific type of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reactions

Examples

H2SO4 and KOH

HCl and NaOH

* *Note: Acids and Bases are opposites. One is always used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the other.*

Combustion Reactions: An element or a compound reacts with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gas to produce energy in the form of heat and light

* Commonly Involve \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Combustion of Hydrocarbons will ALWAYS produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as products
* Combustion will stop when \_\_\_\_\_\_\_\_\_\_\_\_\_ supply is used up or the fuel runs out

Examples

C2H5OH – Ethanol or Ethyl Alcohol “Flame Writing”

C2H5OH + O2 🡪

CH4 – Methane Gas “Light Your Teacher On Fire”

CH4 + 2O2 🡪

CH3OH – Methanol or Methyl Alcohol “Whoosh Bottle”

CH3OH + O2 🡪

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Redox Reactions: A reaction that involves the \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of electrons. It can also deal with the addition of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to a compound.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – Loss of electrons from a substance or the addition of Oxygen to a compound
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – Gain of electrons to a substance or the Loss of Oxygen to a compound
* Both Processes occur simultaneously. One cannot occur without the other
* Single-Replacement, Combination, Decomposition, and Combustion Reactions are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Redox Reactions. There is a transfer of electrons in the process.
* Double-Replacement and Acid-Base Reactions are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Redox Reactions. No electrons are exchanged between the different elements, the ions are just trading partners.

c:\Program Files\Microsoft Office\Clipart\smbusbas\bd10462_.wmf*For each statement, classify the change of the underlined element as [O]xidation, [R]eduction, or [N]either:*

1. \_\_\_\_\_ Cu° → Cu2+ + 2e-
2. \_\_\_\_\_ Al3+ + 3e- → Al°
3. \_\_\_\_\_ CH4 → CO2
4. \_\_\_\_\_ NaOH + HCl → NaCl + H2O
5. \_\_\_\_\_ gaining electrons
6. \_\_\_\_\_ oxidation number increases
7. \_\_\_\_\_ Zn° + 2HCl → ZnCl2 + H2
8. \_\_\_\_\_ Mg + ½O2 → MgO

**Classifying Chemical Reactions**

**Classify the following reactions as synthesis, decomposition, single replacement, or double replacement.**

1. 2KClO3 🡪 2KCl + 3O2
2. HCl + NaOH 🡪 NaCl + H2O
3. Mg + 2HCl 🡪 MgCl2 + H2
4. 2Al + NiBr🡪 2AlBr3 + 3Ni
5. 4Al + 3O2 🡪 2Al2O3
6. 2NaCl 🡪 2Na + Cl2
7. CaCl2 + F2 -> CaF2 + Cl2
8. AgNO3 + KCl 🡪 AgCl + KNO3
9. N2 + H2 🡪 2NH3
10. 2H2O2 🡪 2H2O + O2
11. (NH4)2SO4 + Ba(NO3)2 🡪 BaSO4 + 2NH4NO3
12. 4C + 6H2 + O2 🡪 2C2H6O

**Match each type of chemical reaction in Column II with its description in Column I. Write the letter of the correct reaction in the space provided.**

Column I

\_\_\_\_\_13. A precipitate, water, or a gas forms when two

ionic compounds are dissolved in a solution.

\_\_\_\_\_14. Two or more substances combine to form another

substance.

\_\_\_\_\_15. One element replaces another in a compound.

\_\_\_\_\_16. A substance breaks down into two or more

simpler substances.

Column II

1. synthesis reaction
2. decomposition reaction
3. single replacement reaction
4. double replacement reaction

**Podcast 7.3: Balancing Chemical Equations**

How molecules are symbolized (Sketch each one)

Cl2 2Cl 2Cl2

How many of each atom are in the following?

a) NaOH

b) Ca(OH)**2**

c) 3Ca(OH)**2**

Balancing equations: burning of MgO

* The law of conservation of mass states that matter can neither be created or destroyed; atoms are only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a chemical reaction
* Thus, the number of a particular atom is the same on both sides of a chemical equation

Example 1

Magnesium + Oxygen (sketch)

Mg + O2 → MgO

Balance equations by “inspection”

Hints:

1. start with elements that occur in one compound on each side.

2.Treat\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions that repeat as if they were a single entity.

Examples: Balance the following equations by inspection

1. P**4** + O**2** → P**4**O**10**
2. Li + H**2**O → H**2**+ LiOH
3. Bi(NO**3**)**3** + K**2**S → Bi**2**S**3** + KNO**3**

d) C**2**H**6** + O**2** → CO**2** + H**2**O

Balance by “Atom Inventory”: Set up a table to keep track of the number of atoms of each element on both sides of the equation.

Mg + HCl → MgCl2 + H2

Mg \_\_\_\_\_ Mg \_\_\_\_\_

H \_\_\_\_\_ H \_\_\_\_\_

Cl \_\_\_\_\_ Cl \_\_\_\_\_

1. Ca + N2  → Ca3N2

Ca\_\_\_\_\_ Ca\_\_\_\_\_

N \_\_\_\_\_ N \_\_\_\_\_

1. NH4NO3 → N2O + H2O

N\_\_\_\_\_ N\_\_\_\_\_

H\_\_\_\_\_ H\_\_\_\_\_

O\_\_\_\_\_ O\_\_\_\_\_

1. BiCl3 + H2S → Bi2S3 + HCl

Bi\_\_\_\_\_ Bi\_\_\_\_\_

Cl\_\_\_\_\_ Cl\_\_\_\_\_

H\_\_\_\_\_ H\_\_\_\_\_

S\_\_\_\_\_ S\_\_\_\_\_

1. C4H10 + O2 → CO2 + H2O

C\_\_\_\_\_ C\_\_\_\_\_

H\_\_\_\_\_ H\_\_\_\_\_

O\_\_\_\_\_ O\_\_\_\_\_

**Use the Matrix Method, or Mathematical Method to Balance Equations**  
 Ca3(PO4)2 + H2SO4 → CaSO4 + H3PO4

1. Assign letters to unknown coefficients:

\_\_\_\_\_Ca3(PO4)2 + \_\_\_\_\_ H2SO4 → \_\_\_\_\_CaSO4 + \_\_\_\_\_ H3PO4

1. Make a grid indicating the appearance of element (or ion!) in each species, or term, of the equation. Use a whole number and the coefficient “letter” to indicate each appearance.

\_\_\_\_\_Ca3(PO4)2 + \_\_\_\_\_ H2SO4 → \_\_\_\_\_CaSO4 + \_\_\_\_\_ H3PO4

Ca2+

PO43-

H+

SO42-

1. Simplify Each Equation
2. Solve for the coefficients:

Let a=1 and solve for each variable

a =1

b = \_\_\_\_\_

c = \_\_\_\_\_

d = \_\_\_\_\_

1. Write the equation

\_\_\_\_\_ Ca3(PO4)2 + \_\_\_\_\_H2SO4 → \_\_\_\_\_CaSO4 + \_\_\_\_\_H3PO4

\*It’s not necessary to write the number 1, but it’s shown here to help you remember that a = 1.

# \*What if you get fractions? Get rid of them! Multiply by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Balancing Equations**

Use the inventory method to decide whether the following reactions are balanced.

1. N2H4 + N2O4 🡪 3 N2 + 4 H2O

\_\_\_\_\_\_\_\_\_\_\_ N \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ H \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ O \_\_\_\_\_\_\_\_\_\_\_

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. 4 Ag + 4 H2S + O2 🡪 2 Ag2S + 4 H2O

\_\_\_\_\_\_\_\_\_\_\_ Ag \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ H \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ S \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_ O \_\_\_\_\_\_\_\_\_\_\_

Balanced? Yes\_\_\_\_\_ No\_\_

Write your own inventory tables for the remaining reactions. DON’T GET LAZY!

1. 2 Bi + 3 F2 🡪 2 BiF3

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. Al + Ni(NO3)2 🡪 Al(NO3)3 + Ni

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. 3 NaBH4 + 4 BF3 🡪 2 B2H6 + 3 NaBF4

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. 4 C3H5(NO3)3 🡪 6 N2 + O2 + 12 CO2 + 10 H2O

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. Ca10F2(PO4)6 + 7 H2SO4 🡪 2 HF + 3 Ca(H2PO4)2 + 7 CaSO4

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

*Now practice writing an equation using the given information. Determine if your written equation is balanced or not.*

1. Natural gas contains methane (CH4), which burns with oxygen (O2) in the air to produce (🡪) carbon dioxide (CO2) and water (H2O)

Equation:

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

1. When hydrobromic acid (HBr) reacts with magnesium metal (Mg), hydrogen gas (H2) and magnesium bromide (MgBr2) is produced.

Equation:

Balanced? Yes\_\_\_\_\_ No\_\_\_\_\_

**More Balancing Problems**

Balance the following equations with the correct coefficients to balance them. Do an atom inventory before the equation is balanced to give you an idea of a good starting point. Then do an atom inventory after it has been balanced to check your answers.

1. \_\_\_C + \_\_\_S8 🡪 \_\_\_CS2

|  |  |
| --- | --- |
| C | C |
| S | S |

1. \_\_\_Na + \_\_\_O2 🡪 \_\_\_Na2O2

|  |  |
| --- | --- |
| Na | Na |
| O | O |

1. \_\_\_K + \_\_\_H2O 🡪 \_\_\_KOH + \_\_\_H2

|  |  |
| --- | --- |
| K | K |
| H | H |
| OH | OH |

1. \_\_\_KOH + \_\_\_HBr 🡪 \_\_\_KBr + \_\_\_H2O

|  |  |
| --- | --- |
| K | K |
| OH | OH |
| H | H |
| Br | Br |

1. \_\_\_Al + \_\_\_Pb(NO3)2 🡪 \_\_\_Al(NO3)3 + \_\_\_Pb

|  |  |
| --- | --- |
| Al | Al |
| Pb | Pb |
| NO3 | NO3 |

1. \_\_CH3CH2CH2CH3+\_\_\_O2🡪\_\_\_CO2+ \_\_\_H2O

|  |  |
| --- | --- |
| C | C |
| H | H |
| O | O |

Continue balancing the following equations. You may use INSPECTION or the INVENTORY method. Be sure to double check your answers to make sure the reactants equal the products.

1. \_\_\_N2 + \_\_\_H2 🡪 \_\_\_NH3
2. \_\_\_HCl + \_\_\_NaOH 🡪 \_\_\_NaCl + \_\_\_H2O
3. \_\_\_Cu + \_\_\_AgNO3 🡪 \_\_\_Cu(NO3)2 + \_\_\_Ag (*hint: keep the polyatomic ion together*)
4. \_\_MnO2+\_\_\_HCl🡪\_\_\_MnCl2+\_\_Cl2+ \_\_H2O
5. \_\_\_Cl2 + \_\_\_LiI 🡪 \_\_\_LiCl + \_\_\_I2
6. \_\_\_CH4 + \_\_\_O2 🡪 \_\_\_CO2 + \_\_\_H2O
7. \_\_\_N2 + \_\_\_O2 🡪 \_\_\_N2O5
8. \_\_\_KOH + \_\_\_H3PO4 🡪 \_\_\_K3PO4 + \_\_\_H2O
9. \_\_Na2SO3+\_\_HCl🡪\_\_NaCl+\_\_H2O+\_\_SO2
10. \_\_\_(NH4)2SO4 + \_\_\_KOH 🡪 \_\_\_K2SO4 + \_\_\_NH3 + \_\_\_H2O (Hint: Try the MATRIX METHOD)
11. \_\_\_FeS2 + \_\_\_O2 🡪 \_\_\_Fe2O3 + \_\_\_SO2

*Now practice writing a balanced equation using the given information.*

1. Calcium hydroxide, or slaked lime, is used as an ingredient in mortar and plaster. When calcium hydroxide, Ca(OH)2, reacts with hydrochloric acid, HCl, it forms calcium chloride, CaCl2, and water, H2O.
2. Aluminum sulfate is used in a step in the water purification process known as flocculation, which causes impurities to coagulate into larger particles that can be filtered out or settled more easily. Aluminum sulfate, Al2(SO4)3, is formed along with nitric acid, HNO3, when aluminum nitrate, Al(NO3)3, reacts with sulfuric acid, H2SO4.
3. Because the reaction of alkali metals in air to form nitrides generates extreme amounts of energy, they do not typically occur at standard conditions. Write the balanced equation to describe how cesium, Cs, would react (under extreme conditions) with the nitrogen, N2, in the air to form cesium nitride, Cs3N.

**Chemical Equations: BALANCING EQUATIONS**

1. \_\_ZnS + \_\_HCl → \_\_ZnCl2 + \_\_H2S

2. \_\_HCl + \_\_Cr → \_\_CrCl2 + \_\_H2

3. \_\_Al + \_\_Fe3O4 → \_\_Al2O3 + \_\_Fe

4. \_\_H2 + \_\_Br2 → \_\_HBr

5. \_\_Na2S2O3 + \_\_I2 → \_\_NaI + \_\_Na2S4O6

6. \_\_LaCl3 + \_\_Na2CO3 → \_\_La2(CO3)3 + \_\_NaCl

7. \_\_NH4Cl + \_\_Ba(OH)2 → \_\_BaCl2 + \_\_NH3 + \_\_H2O

8. \_\_Ca(OH)2 + \_\_H3PO4 → \_\_Ca3(PO4)2 + \_\_H2O

9. \_\_La2(CO3)3 + \_\_H2SO4 → \_\_La2(SO4)3 + \_\_H2O + \_\_CO2

10. \_\_Na2O + \_\_(NH4)2SO4 → \_\_Na2SO4 + \_\_H2O + \_\_NH3

11. \_\_C4H10 + \_\_O2 → \_\_CO2 + \_\_H2O

12. \_\_C7H6O2 + \_\_O2 → \_\_CO2 + \_\_H2O

13. \_\_P4O10 + \_\_H2O → \_\_H3PO4

14. \_\_FeS2 + \_\_O2 → \_\_Fe2O3 + \_\_SO2

15. \_\_NH3 + \_\_O2 → \_\_NO + \_\_H2O

16. \_\_Fe + \_\_HCl → \_\_H2 + \_\_FeCl2

17. \_\_PbO2 + \_\_HCl → \_\_H2O + \_\_PbCl2 + \_\_Cl2

18. \_\_Fe2O3 + \_\_H2SO4 → \_\_Fe2(SO4)3 + \_\_H2O

19. \_\_NO2 + \_\_H2O → \_\_NO + \_\_HNO3

20. \_\_C2H6S + \_\_O2 → \_\_CO2 + \_\_H2O + \_\_SO2

Complete combustion:

21. C6H14

22. C2H5OH

23. C3H7OH

24. C6H6

25. C17H35COOH

**Unit 8 – Chemical Equations**

Test Review

1. Define **AND KNOW HOW TO APPLY** the following words and terms:

* Law of Conservation of Mass
* Chemical reaction
* Catalyst
* Coefficients
* Subscript
* Balanced equation
* Skeleton equation
* Word equation
* Synthesis reaction
* Decomposition reaction
* Single replacement reaction
* Double replacement reaction
* Combustion reaction
* Acid/Base reaction

1. What do (s), (l), (aq), and (g) stand for in a chemical reaction?
2. Using the equation CS2 + O2 🡪 CO2 + SO2
   1. Balance the equation.
   2. What type of reaction is this?

*For those of you paying attention, you may make a 3x5 hand-written note card for the test.*

1. Using the equation Sn + HF 🡪 SnF2 + H2:
   1. Balance the equation.
   2. What type of reaction is this?