Chemistry Study Sheet (Chemical Reactions)

Chemical Reaction 🡪 The process by which the atoms of one or more substances is rearranged to form different substances. Its also a name for chemical change.

Evidence for Chemical Reactions:

Temperature Change – Exothermic (Releasing heat) Endothermic (Absorbing heat)

Color Change

Odor

Gas Bubbles

Sudden Appearance of a Solid

Chemical Equations:

Reactants 🡪 Starting Substances for a chemical reaction

Products 🡪 Resulting substances for a chemical reaction

Chemical equations do not express numerical quantities, because chemical reactants are used up as the products form.

Chemical equation syntax table

|  |  |
| --- | --- |
| symbol | meaning |
| + | Seperates two or more products or reactants. (and) |
| 🡪 | Seperates reactants from products (yields) |
| (s) | Identifies a solid |
| (l) | Identifies a liquid |
| (g) | Identifies a gaseous state |
| (aq) | Identifies a water solution. |

**Word Equations:**

Ex:

Iron(s) + chlorine(g) 🡪 iron(III) chloride(s)

The phrase that represents this equation is iron and chlorine react and yield iron(III) chloride.

Some more examples:

Calcium(s) + Chlorine(g) 🡪 Calcium Chloride (g)

The phrase that represents this equation is calcium and chlorine react to yield calcium chloride.

**Skeleton Equations:**

A skeleton formula uses formula units of atoms to show a chemical reaction and the reactants and the products.

Ex:

Fe(s) + Cl2(g) 🡪 FeCl3(s)

Ex:

C(s) + S(s) 🡪 CS2(l)

Notice that these equations are not balanced. They simply serve the purpose of showing the products and the reactants.

Chemical Equation:

These involve the law of conservation of mass. What they mean is that you can’t more one side than you can have on the other. (i.e. they must show that no matter is destroyed during the chemical reaction).

The best way to go about balancing equations is to write at the number of each type of atom on both sides and determine how, by applying coefficients you can get the same number of atoms on each side of the equation.

Lets look at a sample problem:

The skeleton equation of iron(III) and chlorine react to yield iron(III)chloride is:

Fe(s) + Cl2(g) 🡪 FeCl3(s)

There is one iron atom on the left side of the equation and 2 chlorine atom (or so it seems). Then there are 3 Cl atoms on the right side and 1 iron atom.

Here is how the balanced form of the equation looks like:

2Fe + 3Cl2 🡪 2FeCl3

Steps for balancing equations:

Step 1 : Write the skeleton equation for the reaction

Step 2: Count the atoms of the elements in the reactants

Step 3: Do the same thing for the products

Step 4: Change the coefficients to make the number of atoms of each elements equal on both sides of the equation. NEVER CHANGE THE SUBSCRIPTS

Step 5: **Rewrite coefficients in lowest possible ratio**

There is really no way to study for this you just have to do a lot of sample problems until you get the hang of it.

Classifying chemical reactions:

Synthesis Reaction: A reaction in which two or more substances react to produce a third substance.

Ex: 2Na(s) + Cl2 🡪 2NaCl(s)

(This is the balanced form of this equation, some synthesis reactions may not be balanced)

Combustion Reactions: A reaction in which oxygen combine with a substance and **releases energy** in the form of heat and light.

Combustion reactions are common because oxygen reacts with many types of atoms.

A combustion reaction occurs between hydrogen and oxygen when hydrogen is heated. Water is formed during the reaction and a large amount of energy is released.

Here is another example of an important combustion reaction that occurs when coal is burned to produce energy.

C(s) + O2 🡪 CO2(g)

**Combustion reactions are also synthesis reactions, but not all synthesis reaction are combustion reactions.**

Here is an example of a combustion reaction that is a single replacement reaction:

CH4 + 2O2 🡪 CO2 + 2H2O

The product of a combustion reaction will always be Carbon Dioxide and water. Keep in mind that combustion reactions are always exothermic.

Decomposition: A reaction in which one single compound breaks down into two or more elements or new compounds.

AB 🡪 A + B

Decomposition reaction also require an energy source such as heat or light, but this energy source is NEVER shown in the equation.

Single Replacement Reactions: A reaction in which the atoms of one single element replaces the atom of another element in a compound.

A + BX 🡪 AX + B

Remember the oxidation states for the new compound that is being formed.

A lone atom will only replace another of its kind (metal/nonmetal) if it is high on the activity series table than the initial atom in the compound. If it is lower, there is no reaction:

Ag(s) + Cu(NO3)2 🡪 NR

This is because Ag is lower on the activity series table than Cu.

Sometimes you will be required to both predict the product of a chemical equation, and balance it. Bear this in mind when doing sample problems.

Double Replacement Reactions:

In a double replacement reaction you have to compounds exchanging anions or cations

This is seen usually in the form of

AX + BY 🡪 BX + AY

A solid formed during a double replacement reaction is known as the precipitate. In order to find out whether or not there is a precipitate you have to look at table k in the chemistry thing.

Sometimes you mind need to balance double replacement equations and predict their outcomes.

In order to predict their outcomes use this table:

|  |  |  |
| --- | --- | --- |
| Class of Reaction | Reactants | Probable Products |
| Synthesis | Two or more substances | One Compound |
| Combustion | A metal and oxygen  A nonmetal and oxygen  A compound and oxygen | The oxide of the metal  The oxide of the nonmetal  Two or more oxides |
| Decomposition | One compound | Two or more elements and/or compounds |
| Single Replacement | A metal and a compound  A nonmetal and a compound | A new compound and the replaced metal  A new compound and the replaced nonmetal |
| Double Replacement | Two Compounds | Two different compounds, one of which is often a solid, water, or gas. |

Oh, incase you didn’t know, the polyatomic ions are

O, Br, F, H, I, and Cl

In chemical equations these always exist in a diatomic molecule.