

Chapter 7: Chemical Reactions

Chemical reaction: conversion of substances into different substances (by rearranging atoms)

Reactants: substances present before reaction

Products: substances present after reaction

Chemical equation: represents a reaction on paper

Reactants → Products

Phase labels: show the phase of reactants or products

(s) :

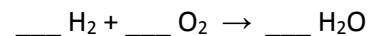
(l) :

(g) :

(aq) :

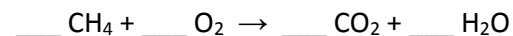
Balancing chemical equations

Law of conservation of mass:

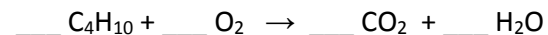


Tips for balancing:

1. Leave elemental substances for last:



2. In an even/odd issue, try doubling all other coefficients



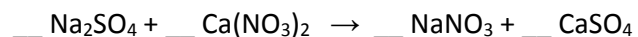
Always make sure all coefficients are reduced to the simplest whole numbers!

Balancing

3. If an element appears in one compound on each side, balance that element first, making the least common multiple on both sides (2b on prelab)



4. If polyatomic ions are identical on both sides, group them when counting

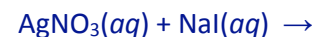


Use the chemical equations worksheet to practice writing and balancing chemical equations.

Solid sodium and liquid water combine to create sodium hydroxide solution and hydrogen gas.

Double displacement, solubility, and precipitation

Double displacement reaction: two ionic reactants swap their ions



1. Write ion pairs for reactants
2. Swap ions, make new +/- pairs, writing + ion first
3. Make formulas for possible products from new ion pairs
4. Balance if necessary
5. Predict phase labels of products

Solubility of ionic compounds

Some ionic compounds easily dissolve in water (**soluble**)

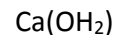
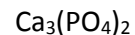
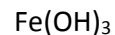
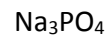
Some never dissolve in water (**insoluble**)

Solubility Rules for Ionic Compounds

The following table will be given on the exam exactly as shown here.

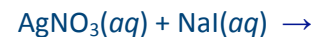
| Compounds Containing the Following Ions Are Mostly Soluble | Exceptions |
|---|---|
| Li ⁺ , Na ⁺ , K ⁺ , NH ₄ ⁺ | None |
| nitrate, acetate | None |
| chloride, bromide, iodide | When any of these ions pairs with Ag ⁺ , Hg ₂ ²⁺ , or Pb ²⁺ , the compound is insoluble |
| sulfate | When sulfate pairs with Sr ²⁺ , Ba ²⁺ , Pb ²⁺ , or Ca ²⁺ the compound is insoluble |

| Compounds Containing the Following Ions Are Mostly Insoluble | Exceptions |
|---|---|
| hydroxide, sulfide | When either of these ions pairs with Li ⁺ , Na ⁺ , K ⁺ , or NH ₄ ⁺ , the compound is soluble When sulfide pairs with Ca ²⁺ , Sr ²⁺ , or Ba ²⁺ , the compound is soluble When hydroxide pairs with Ca ²⁺ , Sr ²⁺ , or Ba ²⁺ , the compound is slightly soluble (for many purposes, these may be considered insoluble) |
| carbonate, phosphate | When either of these ions pairs with Li ⁺ , Na ⁺ , K ⁺ , or NH ₄ ⁺ , the compound is soluble |



Precipitation reaction

Precipitate: insoluble (s) product of a chemical reaction



Write the balanced chemical equation for the reaction of lead(II) nitrate and sodium iodide solutions. If a precipitate forms, what is its name?

Write the balanced chemical equation for the reaction of potassium sulfate and sodium phosphate solutions.

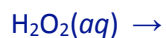
Other reaction types

1. **Combustion reaction** (fire or flame are produced)

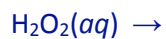


Write a balanced chemical equation for the complete combustion of propane, C₃H₈.

2. **Decomposition reaction**: 1 reactant decomposes into 2 or more products



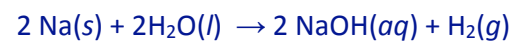
catalysts speed up reactions but are not consumed by the reaction - they are common in decomposition reactions



Other reaction types

3. **Single-displacement reaction**: 1 element is replaced by another

(an element + a compound → another element + another compound)



4. **Synthesis reaction**: 2 or more reactants form 1 product

Write the synthesis reaction that silver and oxygen will undergo.

Review: reaction types

- Double displacement
- Combustion
- Decomposition
- Single displacement
- Synthesis