

CHEMICAL REACTIONS AND EQUATIONS

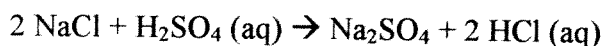
A chemical reaction is a process in which a new substance with different physical and chemical properties is produced. We can express what happens in this process by writing an equation. An equation shows what elements or compounds react and what elements and compounds are produced.

Equations maybe sentences that state a reaction, or formulas and symbols that represent the reaction. The substances on the left side of a reaction are called the reactants, the substances that enter a reaction. The substances on the right side of a reaction are called the products, substances that are produced by a chemical reaction.

Activation energy: energy required to initiate a chemical reaction. When an equation is written in symbols an arrow (\rightarrow) is used to indicate what the reaction yields.

For Example: the reaction between sodium chloride and sulfuric acid might look like either of these:

Sodium chloride and sulfuric acid react to yield sodium sulfate and hydrochloric acid.



BALANCING EQUATIONS

The *Law of Conservation of Matter and Energy* states that in any ordinary chemical reaction matter is neither created nor destroyed, it is simply changed from one form to another. An equation must be balanced. Numbers called coefficients, whole numbers written in front of the reactants and products to indicate the amount of each, are used to maintain the law of conservation. Therefore one might say what goes in must come out, so we must count atoms in and atoms out and they must be equal. Use the following directions to help you balance equations.

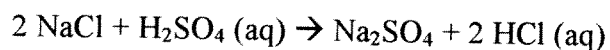
Use coefficients to balance equations, steps to balancing equations:

1. Write a formula equation with correct symbols and formulas.
2. Count the number of atoms of each element on each side of the arrow.
3. Balance atoms by using coefficients.
4. Check your work by counting atoms of each element.

Summary: Chemical equations are written in words, the words are then changed to formulas and then the numbers of atoms are balanced.

- Hints:**
1. Balance singletons last.
 2. Save H and O until last.
 3. Balance polyatomic ions as units.
 4. Remember your diatomic gases!
 5. Write water as H OH, break down as H and OH.

Practice: If we go back to the equation from earlier, we can determine its various parts.



1. What are the reactants? _____
2. What are the products? _____
3. How many atoms of sodium enter the reaction? _____
4. How many atoms of sodium are produced? _____
5. What does the \rightarrow stand for? _____
6. How many moles of hydrogen go into the reaction? _____
7. How many moles of hydrogen are produced? _____
8. How many molecules of HCl are produced? _____
9. What are the coefficients for NaCl? ___ H₂SO₄? ___ Na₂SO₄? ___ HCl? ___

Balance the following equations.

10. ___ Zn + ___ HCl \rightarrow ___ ZnCl₂ + ___ H₂(g)
11. ___ KClO₃ \rightarrow ___ KCl + ___ O₂(g)
12. ___ S₈ + ___ F₂(g) \rightarrow ___ SF₆
13. ___ Fe + ___ O₂(g) \rightarrow ___ Fe₂O₃
14. ___ C₂H₆ + ___ O₂(g) \rightarrow ___ CO₂ + ___ H₂O
15. ___ Mg + ___ O₂(g) \rightarrow ___ MgO
16. ___ H₂O + ___ N₂O₃ \rightarrow ___ HNO₂(aq)
17. ___ Na₂O + ___ H₂O \rightarrow ___ NaOH(aq)
18. ___ Fe + ___ H₂O \rightarrow ___ Fe₃O₄ + ___ H₂(g)
19. ___ Al + ___ Pb(NO₃)₂ \rightarrow ___ Al(NO₃)₃ + ___ Pb

Write and balance the following equations.

20. sodium carbonate and hydrochloric acid react to yield sodium chloride and water and carbon dioxide

21. magnesium and nitric acid react to yield magnesium nitrate and hydrogen gas

22. aluminum and ferric oxide react to produce aluminum oxide and iron

23. potassium phosphate and magnesium chloride react to form magnesium phosphate and potassium chloride

24. ammonia and oxygen react to produce nitrogen gas and water

25. calcium carbonate when heated decomposes into calcium oxide and carbon dioxide

26. sodium chloride and sulfuric acid react to yield sodium sulfate and hydrochloric acid

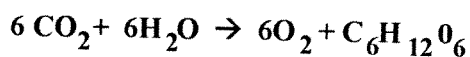
27. fluorine and sodium hydroxide react to form sodium fluoride and oxygen gas and water

28. magnesium nitrate and calcium iodide react to produce calcium nitrate and magnesium iodide

Name: _____ Period: _____ Date: _____
HOMEWORK: CHEMICAL REACTIONS

Match the following:

- | | |
|--------------------------|--|
| ___ 1. Chemical reaction | a. symbol for heat added |
| ___ 2. Reactants | b. substance that enters a chemical reaction |
| ___ 3. Product | c. part of atom involved in chemical bonds |
| ___ 4. Valence electrons | d. process in which a new substance is formed |
| ___ 5. Activation energy | e. symbol for yield |
| ___ 6. \rightarrow | f. needed to initiate a chem. Rxn. |
| ___ 7. Coefficient | g. substance produced in a chem. Rxn. |
| ___ 8. Δ | h. number used to express amount of substance
in a reaction |



9. List the reactants: _____
10. List the products: _____
11. What is the coefficient for water? ___ oxygen gas? ___ carbon dioxide? ___
12. How many oxygen atoms enter the reaction? ___ How many are produced? ___

Balance the following equations:

13. ___ $\text{Al}(\text{NO}_3)_3 + \text{FeCl}_2 \rightarrow \text{Fe}(\text{NO}_3)_2 + \text{AlCl}_3$
14. ___ $\text{BaCl}_2 + \text{NaOH} \rightarrow \text{NaCl} + \text{Ba}(\text{OH})_2$
15. ___ $\text{CH}_4 \rightarrow \text{C} + \text{H}_2$
16. ___ $\text{O}_2 + \text{N}_2 \rightarrow \text{N}_2\text{O}_4$
17. ___ $\text{NaI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{Na}(\text{NO}_3) + \text{PbI}_2$
18. ___ $\text{Cu} + \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}$
19. ___ $\text{K} + \text{H}_2\text{O} \rightarrow \text{KOH} + \text{H}_2(\text{g})$
20. ___ $\text{MnO}_2 + \text{HCl}(\text{aq}) \rightarrow \text{MnCl}_2 + \text{Cl}_2(\text{g}) + \text{H}_2\text{O}$
21. ___ $\text{Cl}_2 + \text{LiI} \rightarrow \text{LiCl} + \text{I}_2(\text{g})$
22. ___ $\text{Ca}(\text{OH})_2 + \text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$

For each of the following reactions, write the formula equation and balance.

18. Ammonia reacts with hydrogen chloride to form ammonium chloride.
19. When heated, calcium carbonate decomposes to form calcium oxide and carbon dioxide.
20. Barium oxide reacts with water to form barium hydroxide.
21. Acetaldehyde (CH_3CHO) decomposes to form methane (CH_4) and carbon monoxide.
22. Zinc reacts with copper (II) nitrate to form zinc nitrate and copper.
23. When heated, calcium sulfite decomposes to form calcium oxide and sulfur dioxide.
24. Iron reacts with sulfuric acid to form iron (II) sulfate and hydrogen gas.
25. Carbon monoxide reacts with chlorine gas to form phosgene (COCl_2)
26. Aluminum sulfate reacts with ammonium bromide to produce aluminum bromide and ammonium sulfate.
27. Potassium fluoride and barium bromide react to yield barium fluoride and potassium bromide.
28. Cupric nitrate and ammonium hydroxide react to form cupric hydroxide and ammonium nitrate
29. Sodium nitrate when heated decomposes to form sodium nitrite and oxygen gas.
30. Lead hydroxide when heated decomposes to produce lead monoxide and water.