

Chemical Equations Unit

Nomenclature

There are two main types of chemicals to name:

- 1.
- 2.

Ionic

Writing Formulas

- Write the symbol of both elements or ions in the name with their valences.
- Cross down the valence numbers (in absolute value)
- Factor those numbers if possible

Naming

- Write the name of the first element
- Check to see if that element has more than one valence.
 - If it only has one, do not add the valence.
 - If it has more than one, find the valence and add it in brackets with a roman numeral.
- Write the name of the second element with an ide ending.

Practice:

Nomenclature of Binary Compounds

Please write the name of the following chemicals

AgCl	
Li ₂ O	
MgBr ₂	
ZnO	
KF	
BaS	
Rb ₂ S	
AlN	
CaCl ₂	
Zn ₃ P ₂	
NaBr	
AlBr ₃	
Cs ₃ P	
SrI ₂	
SrF ₂	

Please write formulas for the following compounds

Magnesium Phosphide	
Lithium Oxide	
Calcium Bromide	
Cesium Sulfide	
Rubidium Phosphide	
Strontium Nitride	
Aluminum Oxide	
Barium Iodide	
Silver Chloride	
Cesium Carbide	
Potassium Carbide	
Barium Oxide	
Zinc Nitride	
Strontium Iodide	
Magnesium Sulfide	

Nomenclature of Multivalent Metal Compounds

Please write the name of the following chemicals

AuCl	
NiN	
CuCl ₂	
FeO	
MnO ₂	
NiBr ₂	
SnS ₂	
PbO ₂	
CrCl ₂	
Mn ₃ P ₂	
PtO	
AuBr ₃	
Cu ₃ P	
AuI ₃	
CoF ₂	

Please write formulas for the following compounds

Chromium (II) Phosphide	
Manganese (IV) oxide	
Iron (III) Bromide	
Copper (II) Sulfide	
Cobalt (III) Phosphide	
Chromium (III) Nitride	
Nickel (II) Nitride	
Palladium (II) Iodide	
Tin (IV) Chloride	
Tungsten (III) Carbide	
Platinum (II) Carbide	
Platinum (IV) Oxide	
Cobalt (III) Nitride	
Lead (II) Iodide	

Nickel (II) Sulfide	
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Nomenclature of Binary and Multivalent Metal

Please write the name of the following chemicals

AgCl	
SnO ₂	
Mg ₃ N ₂	
FeO	
MnC	
BaBr ₂	
SnS ₂	
NiO	
CaCl ₂	
Zn ₃ P ₂	
NiS	
AlBr ₃	
Hg ₃ P	
AuI ₃	
SrF ₂	

Please write formulas for the following compounds

Magnesium Phosphide	
Dihydrogen Monoxide	
Calcium Bromide	
Copper (II) Sulfide	
Rubidium Phosphide	
Chromium (III) Nitride	
Tin (IV) Oxide	
Barium Iodide	
Silver Chloride	
Cesium Carbide	
Potassium Carbide	
Platinum (IV) Oxide	
Cobalt (III) Nitride	

Strontium Iodide	
Nickel (II) Sulfide	

ous/ic naming system

- Older system but some old scientists still use it.
- Only used for multivalent metals
- The higher valence will have an ic ending
- The lower valence will have an ous ending
- You will never name them, but you may be given the name and need to write the formula

Element	Latin	<i>Electrovalence</i>
Hg	Mercurous	1+
	Mercuric	2+
Cu	Cuprous	1+
	Cupric	2+
Fe	Ferrous	2+
	Ferric	3+
Sn	Stannous	2+
	Stannic	4+
Pb	Plumbous	2+
	Plumbic	4+
Mn	Manganous	2+
	Manganic	4+
P	Phosphorous	3+
	Phosphoric	5+
As	Arsenious	3+
	Arsenic	5+
Sb	Antimonous	3+
	Antimonic	5+

Practice:

Nomenclature of Acids:

Binary Acids (only H and an element)

- Naming: Write hydro before the element and give it an ic acid ending.
- Example:
 - HCl
 - HBr
 - HF
 - HI

Oxy Acids

- 2 Oxygens	- 1 Oxygen		+ 1 Oxygen
Hypo...ous acid	-ous acid	-ic acid	Per.....ic acid
HNO Hyponitrous acid	HNO ₂ Nitrous acid	HNO₃ Nitric acid	HNO ₄ Pernitric acid
		HClO₃ Chloric acid	
		HBrO₃ Bromic acid	
		HIO₃ Iodic acid	
		H₂CO₃ Carbonic acid	
		H₂SO₄ Sulfuric acid	
		H₃PO₄ Phosphoric acid	

Nomenclature of Oxy Acids

Please write the name of the following chemicals

HNO ₃	
HClO ₂	
HBrO	
HIO ₄	
H ₂ SO ₃	
H ₂ CO ₂	
H ₃ PO ₄	
HNO ₄	
HBrO ₃	
HClO	
HIO ₂	
H ₂ SO ₄	
H ₂ CO ₃	
H ₃ PO ₅	
HNO	

Please write formulas for the following compounds

Phosphoric Acid	
Sulfurous Acid	
Percarbonic Acid	
Hyponitrous Acid	
Chloric Acid	
Bromous Acid	
Periodic Acid	
Hypophosphorous Acid	
Sulfuric Acid	
Carbonous Acid	
Pernitric Acid	

Hypochlorous Acid	
Bromic Acid	
Iodous Acid	
Perphosphoric Acid	

Oxy Acid Radicals

- 2 Oxygens	- 1 Oxygen		+ 1 Oxygen
Hypo...ite	-ite	ate	Per.....ate
NO^{1-} Hyponitrite	NO_2^{1-} Nitrite	NO_3^{1-} Nitrate	NO_4^{1-} Pernitrate
		ClO_3^{1-} Chlorate	
		BrO_3^{1-} Bromate	
		IO_3^{1-} Iodate	
		CO_3^{2-} Carbonate	
		SO_4^{2-} Sulfate	
		PO_4^{3-} Phosphate	

Practice:

Nomenclature of Oxy Acid Radicals

Please write the name of the following chemicals

AgClO ₃	
Ca(NO ₂) ₂	
Mg(NO ₄) ₂	
Fe(BrO) ₃	
MnCO ₂	
Ba(BrO ₃) ₂	
SnSO ₂	
NaNO ₂	
Ca(ClO) ₂	
Zn ₃ (PO ₃) ₂	
NiSO ₄	
Al(BrO ₃) ₃	
Hg ₃ PO ₅	
Au(IO ₂) ₃	
SrCO	

Please write formulas for the following compounds

Magnesium Phosphite	
Zinc Hypochlorite	
Calcium Bromate	
Copper (II) Sulfite	
Rubidium Perphosphate	
Chromium (III) Hyponitrite	
Potassium Periodate	
Barium Hypiodite	
Silver Chlorate	
Cesium Carbonite	
Potassium Nitrate	

Platinum (IV) Perchlorate	
Cobalt (III) Hyponitrite	
Strontium Iodite	
Nickel (II) Sulfate	

Other Ions you are required to know:

You are required to know

- Hydroxide
- Ammonium
- Acetate

Example:

Sodium Hydroxide

Ammonium Chloride

Beryllium Acetate

Covalent Nomenclature

Memorize the following prefixes:

1	6
2	7
3	8
4	9
5	10

Naming

1. Write the prefix for the first non-metal if there is more than one of it
2. Write the name of the first element.
3. Write the prefix of the second element
4. Write the name of the second element

Practice:

Nomenclature of Covalent Bonds

Please write the name of the following chemicals

CO ₂	
S ₂ O ₅	
CH ₄	
SO ₂	
CO	
SO ₃	
H ₂ O	
NO ₂	
CCl ₄	
NO	
S ₂ P ₃	
NCl ₃	
PF ₃	
SF ₆	
NCl ₅	

Please write formulas for the following compounds

Nitrogen Pentachloride	
Dihydrogen Monoxide	
Sulfur Hexafluoride	
Phosphorus Trifluoride	
Nitrogen Trichloride	
Disulfur Triphosphide	
Sulfur trioxide	
Nitrogen Monoxide	
Carbon Tetrachloride	
Nitrogen Dioxide	
Carbon Monoxide	

Sulfur Dioxide	
Carbon Tetrahydride	
Disulfur Pentoxide	
Carbon Dioxide	

Nomenclature Practice

Chemical Formula	Chemical Name	Chemical Name	Chemical Formula
LiNO_3		Lithium Chlorate	
Ag_2SO_4		Silver Nitrite	
KNO_2		Iron (II) Chlorite	
$\text{Fe}_2(\text{SO}_3)_3$		Potassium Nitrate	
$\text{Be}(\text{IO})_2$		Iron (III) Hypochlorite	
MnSO_4		Zinc Carbonate	
NaIO_2		Lead (II) Perchlorate	
$\text{Ni}_2(\text{SO}_3)_3$		Beryllium Sulfite	
$\text{Mg}(\text{IO}_3)_2$		Nickel (III) Iodate	
$\text{Hg}_3(\text{PO}_4)_2$		Magnesium Sulfate	
$\text{Ca}(\text{BrO})_2$		Lead (IV) Periodate	
$\text{Pb}_3(\text{PO}_4)_4$		Calcium Phosphite	
$\text{Ba}(\text{BrO}_2)_2$		Nickel (II) Hypoiodite	
$\text{Sn}_3(\text{PO}_3)_2$		Barium Phosphate	
LiBrO_3		Gold (I) Iodite	
Ag_3PO_5		Lithium Perphosphate	
KBrO_4		Silver Phosphate	
FeCO_3		Gold (III) Hypoiodite	
$\text{Be}(\text{IO}_4)_2$		Potassium Phosphite	
MnSO_4		Copper (II) Periodate	
NaClO		Zinc Sulfate	
NiSO_3		Copper (I) Iodate	
$\text{Mg}(\text{ClO}_2)_2$		Beryllium Sulfite	
HgSO_4		Manganese(II) Perchlorate	
$\text{Ca}(\text{ClO}_3)_2$		Magnesium Carbonate	
PbCO_3		Manganese (IV) Hypochlorite	
$\text{Ba}(\text{ClO}_4)_2$		Calcium Nitrate	

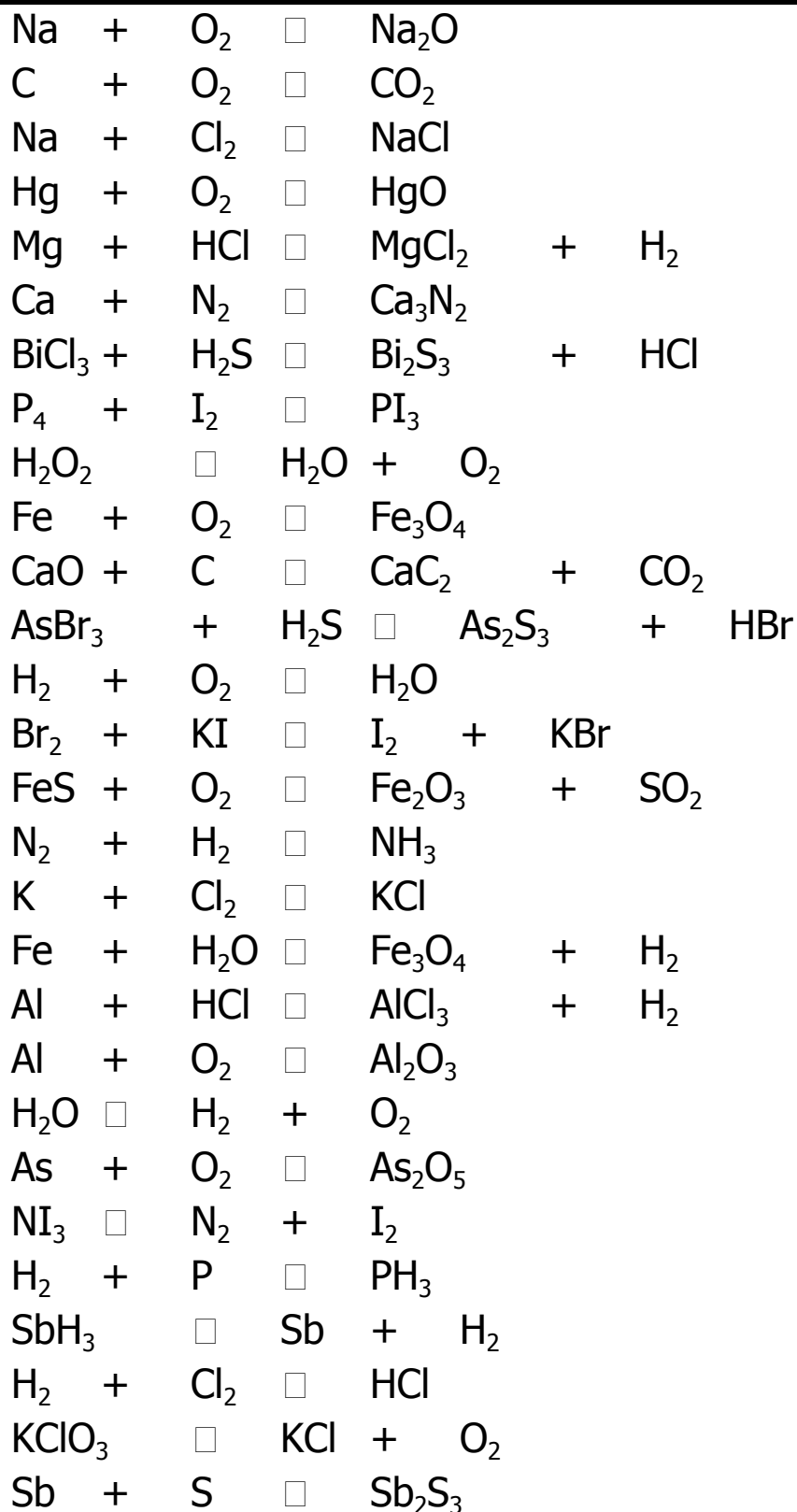
$\text{Sn}(\text{SO}_4)_2$		Tin (II) Chlorite	
ZnCO_3		Barium Nitrite	
AuPO_4		Tin (IV) Chlorate	
AgNO_3		Tin (II) Chloride	
AlPO_3		Sodium Phosphide	
$\text{Ba}(\text{ClO}_2)_2$		Antimony (V) Sulphide	
FeSO_3		Hydrogen Iodide	
KIO_3		Potassium Nitride	
H_3PO_2		Nickel (III) Oxide	
$\text{Sn}(\text{SO}_4)_2$		Mercury (I) Oxide	
$\text{As}(\text{NO}_3)_3$		Potassium Chloride	
NaCH_3COO		Zinc Phosphide	
$\text{Cr}(\text{NO}_3)_3$		Iron (III) Fluoride	
HgClO		Lead (IV) Oxide	
CuSO_4		Phosphorus PentaChloride	
$(\text{NH}_4)_2\text{CO}_3$		Zinc Chloride	
$\text{Fe}_3(\text{PO}_3)_2$		Carbon Monoxide	
$\text{Zn}(\text{ClO})_2$		Carbon Dioxide	
SbPO_3		Sulfur Dioxide	
$\text{Cu}(\text{ClO}_4)_2$		Sulfur Trioxide	
KBrO_4		Hydrogen Chloride	
$(\text{NH}_4)_2\text{SO}_4$		Carbon Tetrachloride	
K_3PO_2		Iron (II) Sulfide	
HIO_3		Barium Chloride	
Na_2O		Tin (IV) Oxide	
K_2O		Arsenic (III) Hydride	
NaClO_4		Diphosphorus TriOxide	
$\text{As}(\text{NO}_3)_5$		Arsenic TriHydride	
$\text{Sb}_2(\text{SO}_3)_3$		Diphosphorus TriOxide	
$\text{Zn}_3(\text{PO}_4)_2$		Diarsenic PentaSulphide	
Ag_2SO_4		Gold (I) Bromide	
$\text{Au}(\text{ClO}_3)_3$		Magnesium Iodide	
$\text{Mg}(\text{BrO}_4)_2$		Beryllium Chloride	
$\text{Ca}_3(\text{PO}_2)_2$		Boron Trihydride	

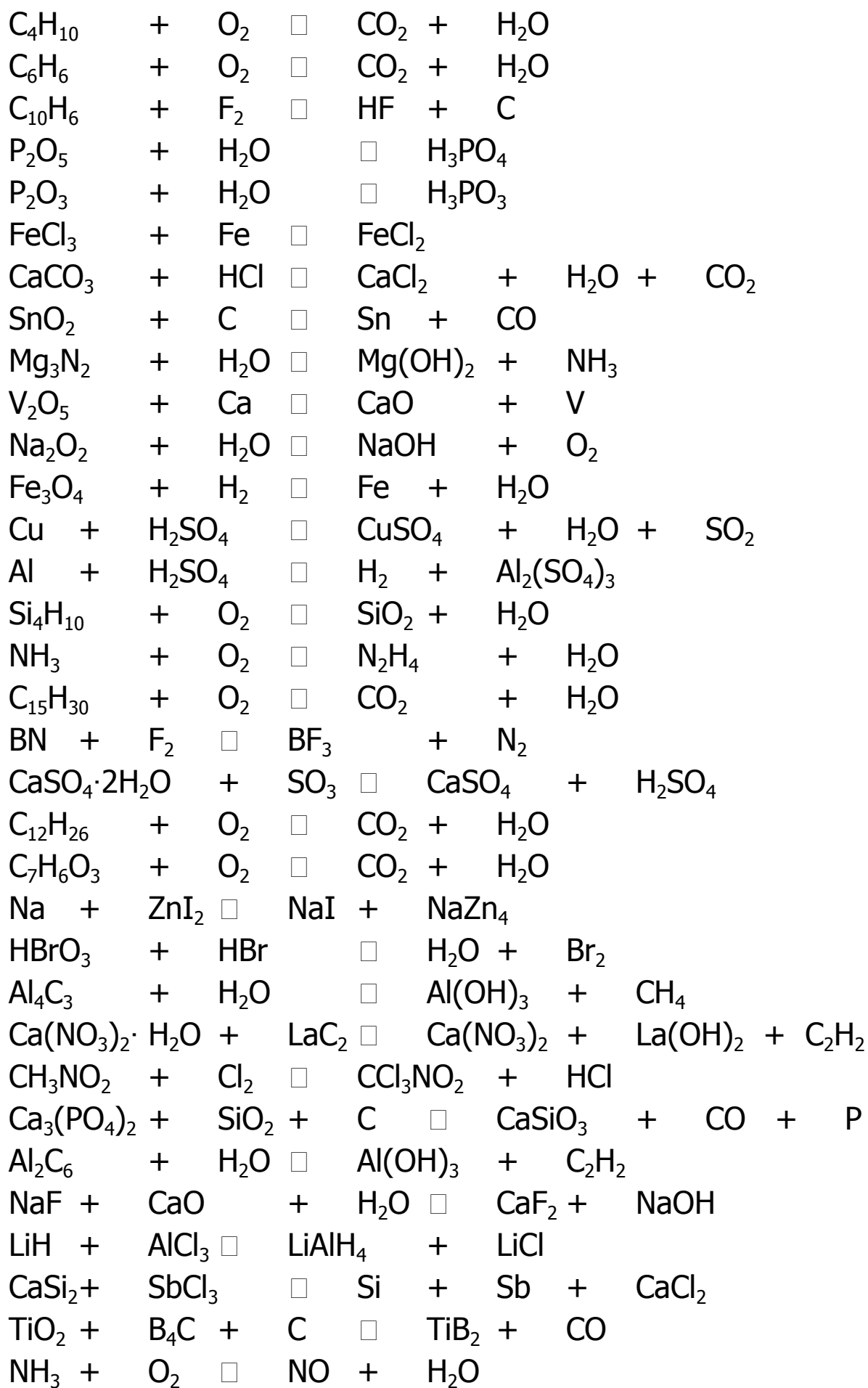
$\text{Al}_2(\text{SO}_3)_3$		Aluminum Oxide	
MnSO_3		Antimony (III) Iodide	
$\text{Pb}(\text{IO}_2)_2$		Cuprous Sulfide	
$\text{Cu}(\text{BrO}_4)_2$		Dihydrogen Monoxide	
H_2SO_3		Silver Chloride	
$\text{Fe}_2(\text{SO}_3)_3$		Lithium Sulfide	
KClO_4		Barium Sulfide	
Na_2SO_4		Strontium Phosphide	
HgClO_2		Ferric Iodide	
$\text{Ca}(\text{CH}_3\text{COO})_2$		Stannic Chloride	
Ag_2CO_3		Plumbous Nitride	
$\text{Sr}(\text{NO}_3)_2$		Antimony (III) Carbide	
$(\text{NH}_4)_3\text{PO}_3$		Dihydrogen Monosulfide	
Ag_3N		Ammonia	
Cu_3N_2		Plumbic Oxide	
LiCl		Copper (II) Chloride	
PbO_2		Silicon Dioxide	
Na_2S		Chromium (III) Chloride	
SnBr_2		Nickel (III) Fluoride	
CaBr_2		Beryllium Oxide	
MnI_4		Carbon Disulphide	
MgI_2		Manganese (II) Oxide	
HgF		Phosphorus Trioxide	
BeF_2		Cobalt (II) Sulfide	
Au_2O_3		Carbon Tetrafluoride	
BaO		Ferrous Sulphide	
NiS		Nitrogen Trihydride	
ZnS		Cupric Oxide	
FeO		Mercury (II) Carbide	
AlN		Diphosphorus Pentoxide	
CuCl_2		Antimony (V) Nitride	
BF_3		Nickel (II) Bromide	
PbCl_2		Dichlorine Monoxide	
AgIO_2		Chromium (II) Sulphide	

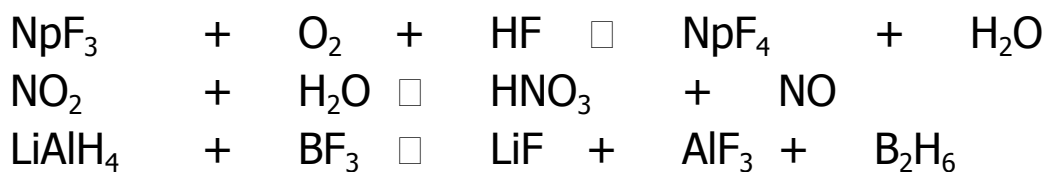
$\text{Zn}_3(\text{PO}_3)_2$		Boron Sulfide	
$\text{Fe}(\text{BrO}_4)_2$		Aluminum Nitride	
$\text{Ca}(\text{ClO}_4)_2$		Sodium Oxide	
LiIO		Stannous Fluoride	
SnSO_3		Copper (I) Sulfide	
$\text{Mg}_3(\text{PO}_2)_2$		Silver Sulfide	
$\text{As}(\text{IO}_4)_5$		Lithium Carbide	
$\text{Pb}(\text{OH})_2$		Calcium Phosphide	
$\text{Ba}(\text{ClO})_2$		Strontium Bromide	
HgNO_3		Magnesium Phosphide	
K_2SO_3		Sodium Phosphite	
$(\text{NH}_4)_3\text{PO}_4$		Iron (II) Perchlorate	
H_2CO_3		Zinc Sulfite	
Ni_2S_3		Cupric Chlorite	
$\text{Al}(\text{IO})_3$		Calcium Hypochlorite	
NaIO_2		Tin (IV) Chlorite	
$\text{Pb}(\text{OH})_4$		Copper (II) Hypobromite	
HBrO_2		Manganic Hypophosphite	
$\text{Mg}_3(\text{PO}_3)_2$		Zinc Carbonate	
Sb_2O_5		Arsenic Nitrite	
AgCH_3COO		Calcium Acetate	
SnF_2		Antimonous Chlorite	
$\text{Cu}(\text{ClO}_2)_2$		Silver Acetate	
$\text{Mn}(\text{IO}_4)_4$		Tin (II) Chlorite	
$\text{Mg}(\text{ClO})_2$		Sodium Sulphate	
Na_2SO_3		Mercury (II) Perchlorate	
$\text{Ca}(\text{IO}_3)_2$		Calcium Hypophosphite	
$\text{Al}(\text{BrO}_4)_3$		Barium Sulfite	
$\text{Be}_3(\text{PO}_3)_2$		Plumbic Phosphite	
$\text{Sn}(\text{OH})_2$		Mercury (II) Nitrate	
$\text{Hg}(\text{IO})_2$		Potassium Iodate	
KClO		Aluminum Hypophosphite	
NH_4NO_3		Ferric Nitrate	
CaF_2		Sodium Nitride	

ZnBr ₂		Lead (II) Perchlorate	
CO ₂		Antimony (V) Sulfite	
SnCl ₂		Aluminum Sulfate	
CrF ₂		Magnesium Carbonate	
CoO		Iron (II) Hypochlorite	
Mg ₃ N ₂		Perbromic Acid	
AsBr ₃		Ammonium Sulphite	
CuO		Zinc Iodate	
AlBr ₃		Gold (III) Nitrate	
FrH		Copper(I)Hypophosphite	
OBr ₂		Manganous Sulphate	
CuCl		Potassium Periodate	
MnO ₂		Magnesium Hypobromite	
NH ₃		Ammonium Acetate	
Cu ₃ N ₂		Zinc Hydroxide	
MnS ₂		Lithium Oxide	
SO ₂		Aluminum Hydride	

Balancing Equations







Word Equations

The ability to transfer word equations and sentences to balanced chemical reactions, requires many rules and hints. The following are a few to help you

- There are 7 diatomic gases. Anytime these elements are written on their own, they will always be placed as a pair.
 Hydrogen gas
 Nitrogen gas
 Oxygen gas
 Fluorine gas
 Chlorine gas
 Bromine gas
 Iodine gas
- Any element that is written on its own is just the element symbol by itself. Even if they indicate a valence, you only use that number when combining elements to make compounds.
 Example: Iron (II) is written as

- If an acid is formed, the compound must have an H in the formula. (H^+)
 Example: An acid with a chloride is written as

- If a base is formed, the compound must have an OH in the formula. (OH^-)
 Example: A base with a Calcium is written as

- An indicator will let us know if a substance is an acid or a base. The following is a chart to tell you which indicator colour matches either the acid or the base.

Indicator	In Acid	In Base
Bromothymol Blue (BTB)		
Phenolphthalein		
Litmus		

- If a substance with C, H and sometimes O is burned in Oxygen, then the products must be **CO_2** and **H_2O** .

Example:

- If a gas is produced and a burning splint is placed in it, it will indicate which gas is produced

Gas	Reaction when a burning splint is placed in its presence
Hydrogen	
Oxygen	
Carbon Dioxide	

Word Equations

Write a Balanced equation for the following:

1. Hydrogen Gas + Oxygen Gas \square Water
2. Aluminium Metal + Oxygen Gas \square Aluminium Oxide
3. Solid Antimony + Chlorine Gas \square Solid Antimony (V) chloride
4. Iron + Oxygen Gas \square Solid Iron III Oxide
5. Solid Copper II Oxide + Hydrogen Gas \square Copper Metal + Water
6. Hydrogen Gas + Chlorine Gas \square Hydrogen Chloride Gas
7. Solid Magnesium Bromide + Chlorine Gas \square Solid Magnesium Chloride + Bromine Gas
8. Iron Metal + Hydrochloric Acid \square Hydrogen Gas + Solid Iron II Chloride
9. Hydrogen Gas + Nitrogen Gas \square Ammonia Gas
10. Solid Calcium Chloride \square Calcium Metal + Chlorine Gas
11. Metallic iron III was heated with solid sulphur to form a single solid sulphide.
12. Potassium metal was burned in oxygen gas to produce a solid oxide.
13. Solid silicon was burned in pure bromine gas to form a single solid product.

14. Solid arsenic with a valence of 5 was burned in oxygen gas to produce a single solid white powder.
15. When a spark was passed through a mixture of nitrogen gas and hydrogen gas, the resulting explosion produced a single gaseous product.
16. When hot carbon monoxide is passed over iron ore (iron III oxide), MOLTEN iron and carbon dioxide are produced.
17. Phosphorus powder in valence state V is completely oxideized in pure oxygen gas to produce fine white powder.
18. Solid sulphur (IV) is burned in oxygen gas to produce a strong smelling gas.
19. The solid oxide of magnesium is mixed with water causing BTB to turn blue when added to the resulting solution.
20. Arsenic V oxide powder is dissolved in water to form an acid similar to phosphoric acid.
21. Calcium metal is added to water. A gas is produced that pops when a burning splint is inserted. BTB turns blue when added to the water.
22. Lithium metal when added to water melts, ignites and produces small explosions, BTB turns blue when added to the water.
23. Magnesium metal added to hydrochloric acid produces an explosive gas and a soluble binary compound.
24. When zinc metal is added to hydrochloric acid, a gas is released. This gas is the same gas that is produced when all metals react with an acid or with water.
25. A solution of copper II chloride is poured over pieces of lead. The lead rapidly takes on a crusty appearance and the blue colour of the copper ion solution fades.

26. Hot steam passed over pure carbon powder produces carbon monoxide and hydrogen gas.

Types of Chemical Reactions

Types of Chemical Reactions

1. SYNTHESIS

- Synthesis reactions are involved in the combination of smaller atoms/molecules into larger molecules.
- It is the exact opposite of decomposition reactions
- It will have more than one reactant
- It will only have one Product

The General Equation is $A + B \rightarrow AB$

Example: Carbon Dioxide + Water \rightarrow Carbonic Acid

Write the following as balanced chemical reactions

1. Hydrogen + Oxygen \rightarrow Water
2. Nitrogen + Hydrogen \rightarrow Ammonia
3. Lithium Oxide + Water \rightarrow Lithium Hydroxide
4. Sulfur trioxide + Water \rightarrow Sulfuric Acid
5. Lead (II) Oxide + Nitrogen dioxide + Oxygen \rightarrow Lead (II) Nitrate
6. When carbon is added to hydrogen gas, a single gaseous product is produced.
7. When chlorine gas was blown over calcium, a new product is formed.
8. When nitrogen monoxide is released into the air, it combines with water and oxygen gas in the clouds to produce nitric acid.
9. When Bromine gas is blown over Lead with a valence of 4+, a new product is formed.
10. When copper with a valence of 2+ is burned in Nitrogen dioxide and oxygen gas, a single nitrate product is produced.

When determining the product of a synthesis reaction, the only ones you would be required to do is ones where you are combining two elements to form a compound. When creating the product, find the valences of both elements and cross them down to form a compound. Then, balance the equation.

Example: Nickel (III) + Fluorine Gas

11. Zinc + Oxygen gas
12. Tin (IV) + Chlorine gas
13. Gold (III) + Nitrogen gas

14. Calcium + Phosphorus

15. Lithium + Carbon

Types of Chemical Reactions

Types of Chemical Reactions

2. Decomposition

- Large molecules are split or broken down into elements or smaller compounds
- It is the exact opposite of synthesis reactions
- It will only have one Reactant
- It will have more than one Product

The General Equation is $AB \rightarrow A + B$

Example: Carbonic Acid \rightarrow Carbon Dioxide + Water

Write the following as balanced chemical reactions

16. Mercury(I)oxide \rightarrow Mercury + Oxygen

17. Iron(II)oxide \rightarrow Iron + Oxygen

18. Antimony(V)oxide \rightarrow Antimony + Oxygen

19. Magnesium chlorate \rightarrow Magnesium chloride + Oxygen

20. Xenon hexafluoride \rightarrow Xenon + Fluorine

21. When an electric current is run through water, it will produce two elemental gases.

22. When Iron(III)Chloride is heated, it decomposes into it's elements.

23. When Potassium Chlorate is heated, it decomposes into Potassium Chloride and Oxygen gas.

24. When Aluminum Bromate is heated, it decomposes into Aluminum Bromide and Oxygen gas.

25. When Carbonic Acid decomposes, it produces carbon dioxide gas and water vapours.

When determining the product of a decomposition reaction, the only ones you would be required to do is ones where you are decomposing a reactant that is made up of only two elements. When creating the products, write both elements separately with a + sign in the middle. See if any are diatomic gases, if so, place the subscript 2. Then, balance the equation.

Example: Nickel(III)fluoride

26. AlN

27. Zinc Chloride

28. Gold (III) sulfate

29. Chromium (III) Iodide

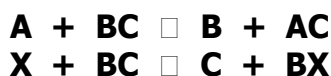
Types of Chemical Reactions

Types of Chemical Reactions

3. Single Displacement

- Single displacement reactions have the single element replaces another element in the product
- It will have an element and a compound in the reactants
- It will have an element and a compound in the products

The General Equation is



if A is a metal
if X is a non metal

Example: Zinc + Aluminum Chloride \rightarrow Aluminum + Zinc Chloride

Fluorine + Gold (III) Nitride \rightarrow Nitrogen + Gold (III) Fluoride

Write the following as balanced chemical reactions

31. Sodium + Aluminum chloride \rightarrow Aluminum + Sodium Chloride

32. Chlorine gas + Lithium Bromide \rightarrow Bromine Gas + Lithium Chloride

33. Magnesium + Silver Nitrate \rightarrow Silver + Magnesium Nitrate

34. Lead + Copper (II) Oxide \rightarrow Copper + Lead (IV) Oxide

35. Fluorine + Aluminum Iodide \rightarrow Iodine + Aluminum Fluoride

Write the following as balanced chemical reactions

36. When Lithium Sulfide is mixed with Gold with a valence of 3+, a new ionic compound is formed.

37. When chlorine gas was blown over calcium bromide, a new product is formed and a gas was released.

38. When Nickel (III) Sulfate is mixed with Zn, a new metal is produced.

39. When Bromine gas is blown over Lead (IV) Oxide, a crusty coating appears on the oxide.

40. When Calcium is added to aqueous Copper (II) Nitrate, the solution loses its blue colour and is replaced with a dark orange metal.

41. Zinc + Potassium Oxide

42. Tin (IV) Sulfide + Chlorine gas

43. Gold (III) + Magnesium Nitride

44. Calcium Fluoride + Phosphorus

Types of Chemical Reactions

Types of Chemical Reactions

4. Double Displacement

- Single elements in different compounds replace themselves in the compounds found in the product.
- Element switch positions with another element of the same charge
- The reactants will be two compounds
- The products will be two compounds

The General Equation is



Example: Lithium Bromide + Calcium Oxide \rightarrow Calcium Bromide + Lithium Oxide

Write the following as balanced chemical reactions

46. Potassium Carbonate + Barium Chloride \rightarrow Barium Carbonate + Potassium Chloride

47. Sodium Carbonate + Sulfuric Acid \rightarrow Carbonic Acid + Sodium Sulfate

48. Aluminum Sulfate + Calcium Phosphate \rightarrow Calcium Sulfate + Aluminum Phosphate

49. Chromium (III) Sulfite + Sulfuric Acid \rightarrow Sulfurous Acid + Chromium (III) Sulfate

50. Zinc Phosphate + Gold (III) Sulfate \rightarrow Gold (III) Phosphate + Zinc Sulfate

51. Tin (II) Chloride + Aluminum Sulfide \rightarrow

52. Calcium Oxide + Gold (III) Nitride \rightarrow

53. Lead (IV) Bromide + Magnesium Sulfide \rightarrow

54. Sulfuric Acid + Nickel (III) Nitrate \rightarrow

55. Barium Sulfite + Lithium hypochlorite \rightarrow

56. When copper (II) Nitrate is added to Lithium Hydroxide, the blue colour of the copper (II) nitrate begins to disappear.

57. When nitrous acid is poured into zinc phosphate, a new acid and a new ionic compound are formed.

58. When Ammonium Chloride and Zinc Oxide are mixed, it produces two new chemicals

59. When Phosphoric Acid is mixed with Strontium nitrate, the phosphoric acid is destroyed but when you add litmus paper to the product, it turns red.

60. When beryllium oxide is mixed with lithium hypobromite, two new chemicals are formed.

Types of Chemical Reactions

Types of Chemical Reactions

4.b) Neutralization

- Include an Acid and a Base
- Always produce an ionic salt
- Always produce water

The General Equation is **Acid + Base \rightarrow Salt + Water**

Example: Sodium Hydroxide + Hydrochloric Acid \rightarrow Sodium Chloride + Water

Write the following as balanced chemical reactions

61. Hydrochloric acid + Barium Hydroxide \rightarrow Barium Chloride + Water

62. Calcium Hydroxide + Nitric Acid \rightarrow Calcium Nitrate + Water

63. Hydrobromic acid + Potassium Hydroxide \rightarrow Potassium Bromide + Water

64. Lithium Hydroxide + Phosphoric acid \rightarrow Lithium Phosphate + Water

65. Hydrofluoric acid + Aluminum Hydroxide \rightarrow Aluminum Fluoride + Water

When predicting the products of the neutralization reaction, you follow the same rules as for double displacement. The good thing about neutralization is you know one of your products will always be water.

Example: Sodium Hydroxide + Carbonic acid \rightarrow

66. Hydroiodic acid + Zinc Hydroxide \rightarrow

67. Barium Hydroxide + Nitric Acid \rightarrow

68. Sulfuric Acid + Lithium Hydroxide \rightarrow

69. Potassium Hydroxide + hydrobromic acid \rightarrow

70. Chloric acid + Magnesium Hydroxide \rightarrow

71. When doing a titration reaction, sodium hydroxide is being neutralized by sulphuric acid.

72. Water was produced when nitric acid was mixed with potassium hydroxide

73. When cleaning up a sulphuric acid spill, the teacher poured lithium hydroxide on the spill before wiping it up.

74. A compound made with Calcium would turn phenolphthalein fuschia in colour, was mixed with hydrochloric acid.

75. A Neutralization reaction occurred between phosphoric acid and magnesium hydroxide.

Types of Chemical Reactions

Types of Chemical Reactions

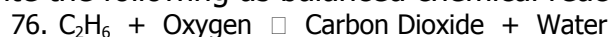
5. Combustion

- Always involves a chemical with C, H and sometimes O.
- O_2 is always a reactant
- CO_2 is always a product
- H_2O is always a product

The General Equation is **Substance with C,H,(maybe O) + $O_2 \rightarrow CO_2 + H_2O$**

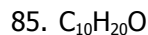
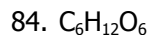
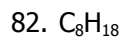
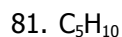
Example: Carbon Tetrahydride + Oxygen \rightarrow Carbon Dioxide + Water

Write the following as balanced chemical reactions



When you are creating combustion questions, remember that combustion means that it is burned. When given the substance, you always have oxygen gas as a reactant and your products are always carbon dioxide and water.

Example: C_6H_6



86. When C_6H_8 is burned in the presence of oxygen, it produces a gas and water vapour

87. When CH_3COOH is burned, it produces lots of gas and water vapour

88. Burning C_3H_4O produces lots of gas

89. Water vapour and carbon dioxide is produced when $C_{10}H_{22}$ is burned

90. Carbon dioxide is one of the products when $C_{12}H_{22}O_{11}$ is burned.

Types of Chemical Reactions Worksheet

Balance the following equations and name the type of reaction.

1. $\text{H}_2\text{O} \square \text{H}_2 + \text{O}_2$ _____
2. $\text{Fe} + \text{CuSO}_4 \square \text{Cu} + \text{FeSO}_4$ _____
3. $\text{Mg} + \text{O}_2 \square \text{MgO}$ _____
4. $\text{Cl}_2 + \text{NaBr} \square \text{NaCl} + \text{Br}_2$ _____
5. $\text{Mg} + \text{HCl} \square \text{MgCl}_2 + \text{H}_2$ _____
6. $\text{NaHCO}_3 \square \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ _____
7. $\text{C} + \text{O}_2 \square \text{CO}_2$ _____
8. $\text{Li} + \text{H}_2\text{O} \square \text{LiOH} + \text{H}_2$ _____
9. $\text{KI} + \text{Pb}(\text{NO}_3)_2 \square \text{PbI}_2 + \text{KNO}_3$ _____
10. $\text{Al} + \text{O}_2 \square \text{Al}_2\text{O}_3$ _____
11. $\text{HgO} \square \text{Hg} + \text{O}_2$ _____
12. $\text{HCl} + \text{NaOH} \square \text{NaCl} + \text{H}_2\text{O}$ _____
13. $\text{CO}_2 + \text{H}_2\text{O} \square \text{H}_2\text{CO}_3$ _____
14. $\text{Na}_2\text{CO}_3 + \text{CuSO}_4 \square \text{Na}_2\text{SO}_4 + \text{CuCO}_3$ _____
15. $\text{NH}_3 + \text{H}_2\text{SO}_4 \square (\text{NH}_4)_2\text{SO}_4$ _____
16. $\text{Cu}(\text{OH})_2 + \text{HNO}_3 \square \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$ _____
17. $\text{Fe}(\text{OH})_3 + \text{H}_2\text{SO}_3 \square \text{Fe}_2(\text{SO}_3)_3 + \text{H}_2\text{O}$ _____
18. $\text{H}_2\text{CO}_3 \square \text{CO}_2 + \text{H}_2\text{O}$ _____
19. $\text{Na}_2\text{S} + \text{Pb}(\text{NO}_3)_2 \square \text{NaNO}_3 + \text{PbS}$ _____
20. $\text{Na}_2\text{O} \square \text{Na} + \text{O}_2$ _____

The Relative Atomic Weight of Magnesium Lab

Purpose:

Atoms cannot be weighed directly. In order to assign a weight to atoms of an element such as magnesium one must compare its weight to another element such as oxygen. This comparison weight is called a relative atomic weight. Experimentally, this is done by reacting magnesium and oxygen and using the ratio of their reacting weights as a measure of their relative weights (on an atom to atom bases). Oxygen is then assigned a specific weight in atomic mass units (u). Using the combining ratio of Mg/O, a specific weight in u is assigned to the magnesium atom. This procedure was used by John Dalton to assign atomic weights. A verification of the Law of Definite Proportions for the elements magnesium and oxygen is also investigated. Dalton's atomic theory supports this law.

Procedure and Observations:

1. Support a crucible with its lid on a clay triangle.
2. Heat the crucible intensely for one minute.
3. Let it cool for 5 minutes.
4. Remove the crucible with flask tongs and weigh the crucible. Record the weight.
m=_____
5. Obtain a 10 cm magnesium ribbon and coil it to fit inside the crucible.
6. Reweigh the crucible and magnesium. Record the weight. m=_____
7. Heat the magnesium in the crucible intensely for at least 10 minutes. Slide the lid across every 30 seconds to allow oxygen to enter. CAUTION: DO NOT STARE AT THE MAGNESIUM FLAME. It produces ultraviolet rays which may harm your eyes. Observe any reaction.
8. Let the crucible cool for 5 minutes.
9. Observe the contents.
10. Re-weigh crucible and magnesium oxide. Record the weight. m=_____
11. Scrape the crucible clean with a scoopula discarding the solid into a waste container.

Calculations and Questions:

1. Calculate the original weight of the magnesium.
2. Calculate the weight of magnesium oxide formed.
3. Calculate the weight of oxygen reacted.
4. Calculate the ratio by weight of magnesium to oxygen (Mg:O).
5. Calculate the weight of one magnesium atom, in amu, given that one oxygen atom weighs 16 amu.
6. Why can't atoms be weighed directly?
7. You based your calculation on the fact that one Mg atom combines with one O atom. Suppose that 2 atoms of O combined with one Mg atom: $\text{Mg} + 2\text{O} = \text{MgO}_2$. What effect would this have on your calculation in #4.
8. Carbon could be substituted for magnesium in this experiment. What problems would exist that were not present with magnesium?
9. Why was the crucible initially heated for one minute?
10. Determine the %yield of the experiment by comparing the value of Mg from your periodic table.

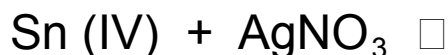
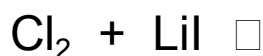
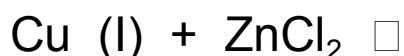
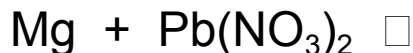
$$\% \text{ yield} = (\text{Actual amount from the experiment})/(\text{Theoretical amount on the periodic table}) \times 100\%$$

Single Displacement with the Activity Series

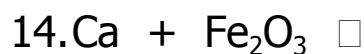
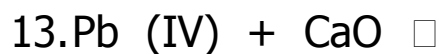
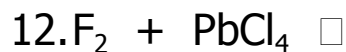
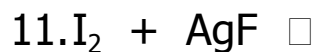
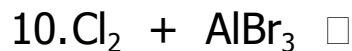
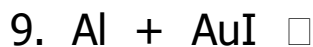
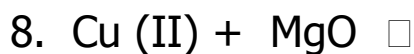
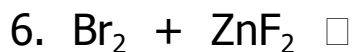
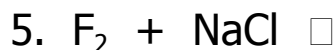
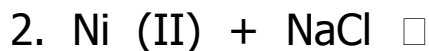
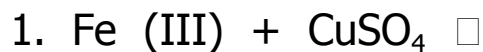
After completing the Reactivity of Metals lab, we are aware that not all single displacement reactions will take place. For the reaction to occur, the single element must be higher on the activity series than the element that is in the compound. If this occurs, the elements will switch places. If this does not occur, there is no reaction.

Do the following reactions take place and if so, what would be their balanced chemical equation.

Examples



Practice Questions

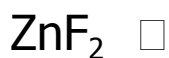


Dissolving Ionic Salts in Water Equations

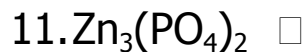
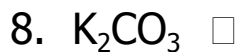
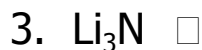
When ionic salts are placed in water, most will dissociate into the different ions.

Remember that ions are charged and must show a **charge** and have **(aq)** as a subscript.

Examples:



Practice Questions:



Creative Chemical Equation

There are many different chemical equations that are occurring all the time at home, in our community and in the world.

Find one balanced chemical equation that happens in your life and display it in a creative form.

Remember:

- 1. The equation must be balanced.**
- 2. The form in which you present your equation is open to your creativity.**
- 3. Please include a sheet of paper with the balanced chemical equation and where it is found in your life.**

Due Date: _____

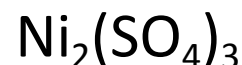
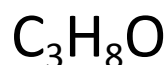
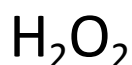
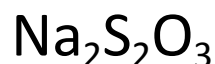
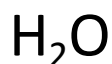
Balancing Redox Equations

Oxidation numbers or Oxidation state - the charge an atom would have if the electrons in each bond entirely belonged to the more electronegative atom. (The apparent charge on an atom in the combined state.)

Assigning Oxidation Numbers to elements

1. Any element when not combined with atoms of a different element has an oxidation number of zero.
2. Any simple monatomic ion has an oxidation number equal to its charge.
3. The sum of the oxidation numbers of all atoms in a compound must equal zero
4. The sum of the oxidation numbers of atom in a radical ion must equal the charge of that ion.
5. The oxidation number of metals in group IA is +1, group IIA is +2, and aluminum is +3
6. H and F in compounds have +1 and -1 oxidation numbers
7. Oxygen has a -2 oxidation number
8. Group 17B has a -1 oxidation number
9. Group 16B has a -2 oxidation number
10. Group 15B has a -3 oxidation number
11. When there is a conflict between two of these rules or an ambiguity in assigning an oxidation number, apply the rule with the lower number and ignore the conflicting rule.

Examples:



Oxidation - a reaction in which a reactant undergoes a loss of electrons.

Reduction - a reaction in which a reactant under goes a gain of electrons.

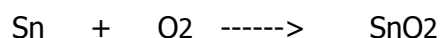
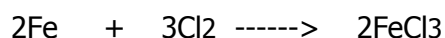
LEO says GER

Loss Electrons Oxidation ----- Gain Electrons Reduction

Oxidizing Agent - the reactant that causes oxidation - the substance that gains the electrons in a reaction.

Reducing Agent - the reactant that causes reduction - the substance that supplies the electrons in a reaction.

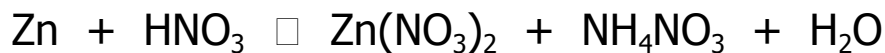
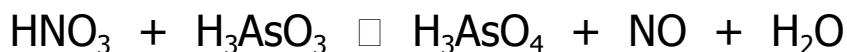
Identify what is oxidized, reduced, the oxidizing agent, the reducing agent



Redox reaction - a chemical reaction in which changes in the oxidation numbers occur

Balancing Redox Equations Using Oxidation Numbers

1. Assign oxidation numbers to the atoms in the equation.
2. Identify which atoms change oxidation number.
3. Compute the total change in oxidation number for the oxidation and reduction that occur.
4. Multiply the change by the number of atoms that are changing in its formula.
5. Make the total increase in oxidation number equal to the total decrease by multiplication using appropriate factors.
6. Balance the remainder by inspection
It may be easier if you balance the Oxygens last
It may be easier if you balance the Hydrogens second last



Balance the following oxidation reduction reactions.

