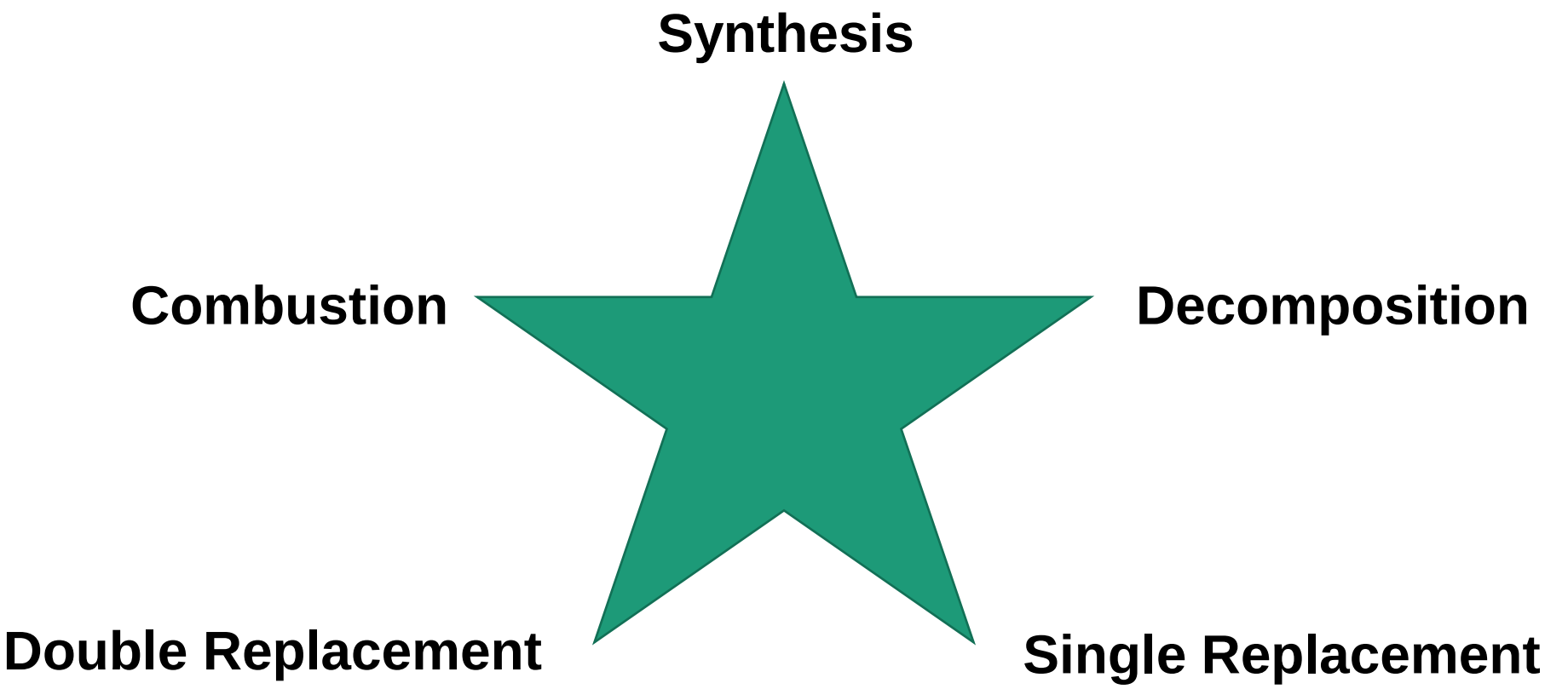
N24- Predicting Products

Target: I can predict products based on patterns of reaction types



Steps

1) **Given words? Turn into formulas**
   - **Neutral compounds! Cross over!**
   - **Diatomics**

2) **Identify type of reaction**
   - **Use flow chart to help if needed!**

3) **Write products**
   - **Neutral compounds! Cross over from scratch!**
   - **Diatomics!**

4) **Balance Equation <u>at the end</u> to fix the numbers!**

Does it happen?

Not all reactions happen in real life!

So many things factor
into if it happens in real life
For this class we will only care about:

Activity Series

Solubility Rules

R-6 in your notebook

Don’t worry!

You do NOT have to memorize them! Only worry about them if you are told to.

You will be given the chart.

Activity Series of Metals

- Lithium
- Potassium
- Calcium
- **Sodium**
- Magnesium
- Aluminum
- Zinc
- Chromium
- Iron
- Nickel
- Lead
- **Hydrogen**
- Bismuth
- Copper
- Mercury
- Silver
- Platinum
- Gold

- Metals can replace other metals **IF** they are **ABOVE** the metal that they are trying to replace
- Metals above hydrogen can replace hydrogen in acids.
- Metals from sodium upward can replace hydrogen in water

Activity Series of Halogens

- Fluorine
- Chlorine
- Bromine
- Iodine

- Halogens can replace other halogens in compounds **IF** they are **ABOVE** the halogen that they are trying to replace.

$2NaCl(s) + F_2(g) \rightarrow 2NaF(s) + Cl_2(g)$

$MgCl_2(s) + Br_2(g) \rightarrow$ No Reaction

Solubility Chart

Soluble means it dissolves in water.

The right hand column are some acronyms to help you remember the rules. We don't memorize, but might speed up your homework!

Copy in your notebook!

Solubility of Some Ionic Compounds in Water

Always Soluble		
Alkali metals =	Li^+, Na^+, K^+, Rb^+, Cs^+	AAA CNP
Ammonium =	NH_4^+	
Acetate =	$C_2H_3O_2^-$	
Chlorate =	ClO_3^-	
Nitrate =	NO_3^-	
Perchlorate =	ClO_4^-	
Generally Soluble		
Cl^-, Br^-, I^-	Soluble *except*: Ag^+, Pb^{2+}, Hg_2^{2+}	AP-H
F^-	Soluble *except*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}, Mg^{2+}	CBS-PM
Sulfate = SO_4^{2-}	Soluble *except*: Ca^{2+}, Ba^{2+}, Sr^{2+}, Pb^{2+}	CBS-P
Generally Insoluble		
O^{2-}, OH^-	Insoluble *except*: Alkali metals and NH_4^+	AA
	Somewhat soluble: Ca^{2+}, Ba^{2+}, Sr^{2+}	CBS
CO_3^{2-} S^{2-}, SO_3^{2-} PO_4^{3-} CrO_4^{2-}, $Cr_2O_4^{2-}$	Insoluble *except*: Alkali metals and NH_4^+	AA

Not Soluble = forms precipitate

Soluble = dissolves in water (aqueous)

Solubility Chart

- Na_2O SOLUBLE b/c it has Na^+ in it!
- $Mg(OH)_2$ INSOLUBLE b/c OH^- insoluble and Mg^{2+} not one of the exceptions

Solubility of Some Ionic Compounds in Water

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Prediction Products Practice #1

Sodium plus Oxygen yields ???

$$Na + O_2 \rightarrow$$

What type of reaction does this look like?

Synthesis

$$Na + O_2 \rightarrow NaO_2$$ NO!!!

Ionic so cross over! Don't steal subscripts!

$$\overset{+1}{Na} + O_2 \rightarrow \overset{-2}{Na_2O}$$

Fix numbers with balancing

$$4Na + O_2 \rightarrow 2Na_2O$$

Prediction Products Practice #2

Sodium chloride breaks into its components

$NaCl \rightarrow$???

What type of reaction does this look like?

Decomposition

$NaCl \rightarrow Na + Cl$ NO!!! Diatomic

$NaCl \rightarrow Na + Cl_2$ Balance

$2NaCl \rightarrow 2Na + Cl_2$

Prediction Products Practice #3

Aluminum is added Lead(II) Nitrate

$Al + Pb(NO_3)_2 \rightarrow ???$

Is Al above Pb on Activity Series?

Yes! So rxn will happen!

What type of reaction does this look like?

Single Replacement

Does Al make cation or anion?

Cation

$Al + Pb(NO_3)_2 \rightarrow Pb + Al(NO_3)_2$ NO!!!

Ionic so cross over!

$Al + Pb(NO_3)_2 \rightarrow Pb + \overset{+3}{Al}(\overset{-1}{NO_3})_3$

Balance

$2Al + 3Pb(NO_3)_2 \rightarrow 3Pb + 2Al(NO_3)_3$

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

Prediction Products Practice #3

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

The Balanced Equation

$$2Al + 3Pb(NO_3)_2 \rightarrow 3Pb + 2Al(NO_3)_3$$

The Overall Equation

$$2Al_{(s)} + 3Pb(NO_3)_{2(aq)} \rightarrow 3Pb_{(s)} + 2Al(NO_3)_{3(aq)}$$

The Complete Ionic Equation

$$2Al_{(s)} + 3Pb^{2+}_{(aq)} + 6NO_3^-{}_{(aq)} \rightarrow 3Pb_{(s)} + 2Al^{3+}_{(aq)} + 6NO_3^-{}_{(aq)}$$

The Net Ionic Equation

$$2Al_{(s)} + 3Pb^{2+}_{(aq)} \rightarrow 3Pb_{(s)} + 2Al^{3+}_{(aq)}$$

Spectator Ions

Prediction Products Practice #4

$Pb(NO_3)_2 + KI \rightarrow ???$

What type of reaction does this look like?

Double Replacement

$Pb(NO_3)_2 + KI \rightarrow PbI + K(NO_3)$ NO!!!

Ionic so cross over!

$Pb(NO_3)_2 + KI \rightarrow PbI_2 + K(NO_3)$

Balance

$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2K(NO_3)$

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

Prediction Products Practice #4

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

The Balanced Equation

$$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2K(NO_3)$$

The Overall Equation

$$Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \rightarrow PbI_{2(s)} + 2K(NO_3)_{(aq)}$$

The Complete Ionic Equation

$$Pb^{2+}_{(aq)} + 2NO_3^-{}_{(aq)} + 2K^+_{(aq)} + 2\ I^-_{(aq)} \rightarrow PbI_{2(s)} + 2K^+_{(aq)} + 2NO_3^-{}_{(aq)}$$

The Net Ionic Equation

$$Pb^{2+}_{(aq)} + 2\ I^-_{(aq)} \rightarrow PbI_{2(s)}$$

Spectator Ions

Prediction Products Practice #5

A solution of Silver Nitrate with a solution of potassium chloride

What type of reaction does this look like?

Double Replacement

$AgNO_3 + KCl \rightarrow AgCl + KNO_3$

Already neutral!

$AgNO_3 + KCl \rightarrow AgCl + KNO_3$

Already Balanced!

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

Prediction Products Practice #5

NOT DONE!!!! NEED TO THINK ABOUT PHASES!

The Balanced Equation

$$AgNO_3 + KCl \rightarrow AgCl + KNO_3$$

The Overall Equation

$$AgNO_{3(aq)} + KCl_{(aq)} \rightarrow AgCl_{(s)} + KNO_{3(aq)}$$

The Complete Ionic Equation

$$Ag^+_{(aq)} + \cancel{NO_3^-_{(aq)}} + \cancel{K^+_{(aq)}} + Cl^-_{(aq)} \rightarrow AgCl_{(s)} + \cancel{K^+_{(aq)}} + \cancel{NO_3^-_{(aq)}}$$

Spectator Ions

The Net Ionic Equation

$$Ag^+_{(aq)} + Cl^-_{(aq)} \rightarrow AgCl_{(s)}$$

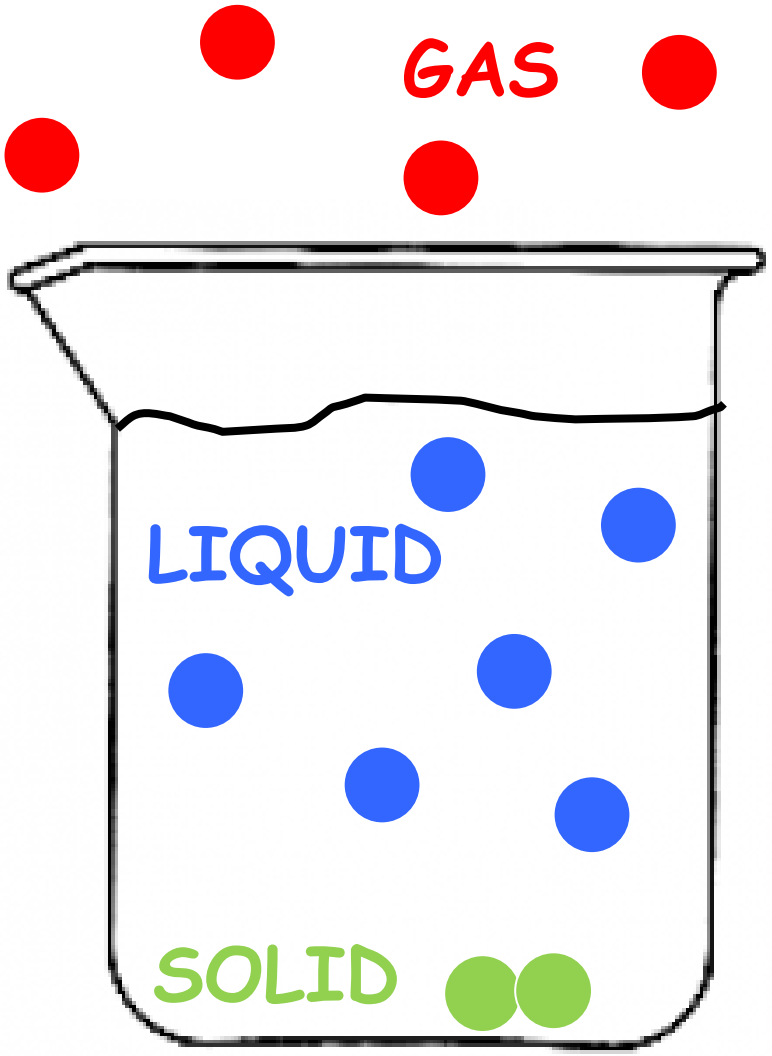
Particulate Diagrams

Particulate Diagrams help our brains!

Use little color coded (or labeled) circles to represent particles

A "particle" can be an atom, an ion, a polyatomic ion, compound or molecule.

Use the right number of circles! Draw them to represent phases too!

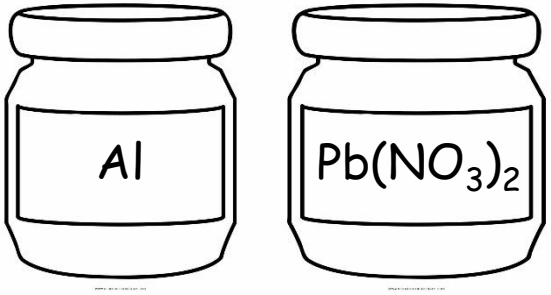


Prediction Products Practice #3

Particulate Diagrams help our brains!

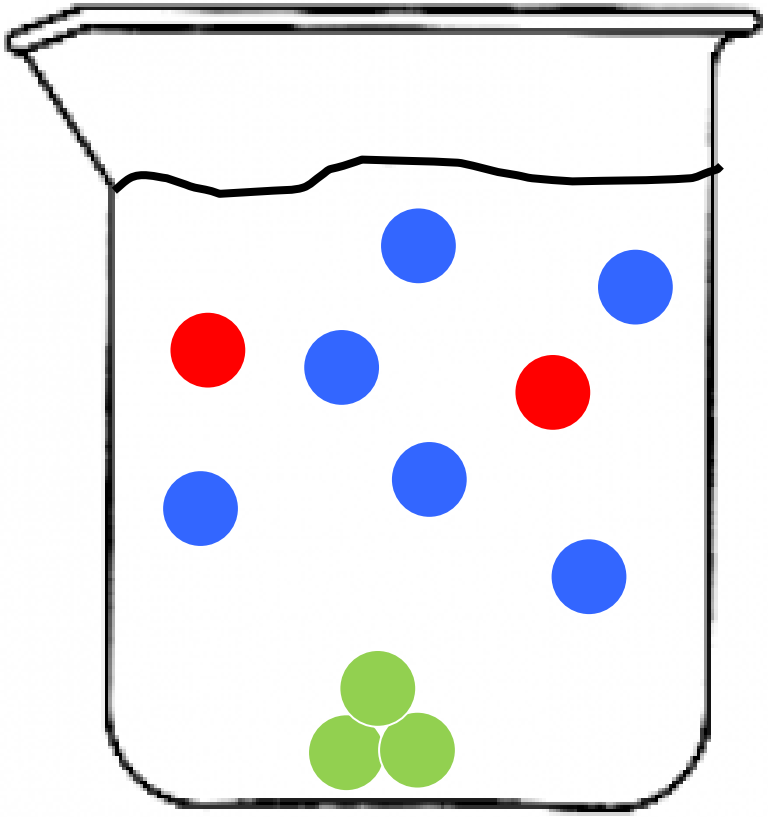
The Balanced Equation

$$2Al + 3Pb(NO_3)_2 \rightarrow 3Pb + 2Al(NO_3)_3$$



Jars of chemicals in stock room

Dump into beaker…



Prediction Products Practice #4

Particulate Diagrams help our brains!

The Balanced Equation

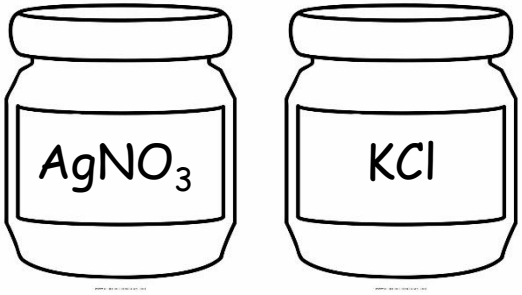
$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2K(NO_3)$

Prediction Products Practice #5

Particulate Diagrams help our brains!

The Balanced Equation

$AgNO_3 + KCl \rightarrow AgCl + KNO_3$



Jars of chemicals in stock room

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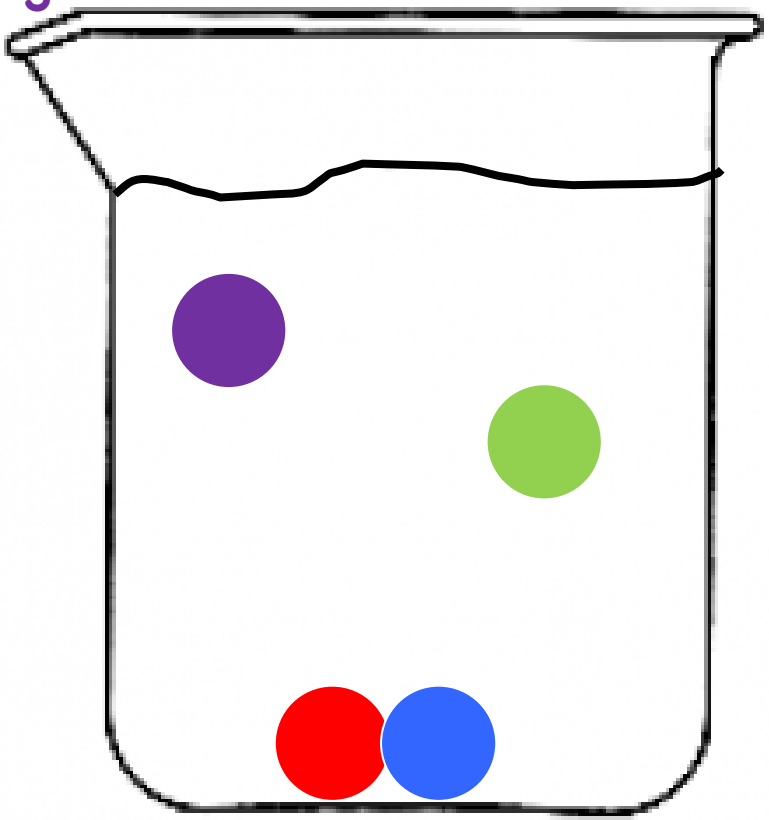
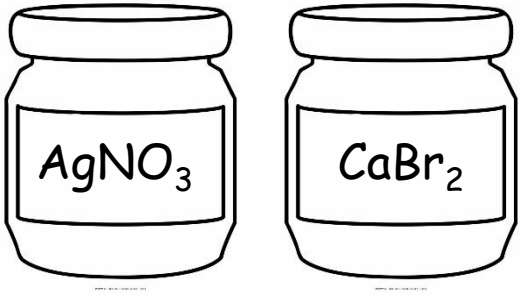


You Try One!

Particulate Diagrams help our brains!

The Balanced Equation

$$2AgNO_3 + CaBr_2 \rightarrow 2AgBr + Ca(NO_3)_2$$



Jars of chemicals in stock room

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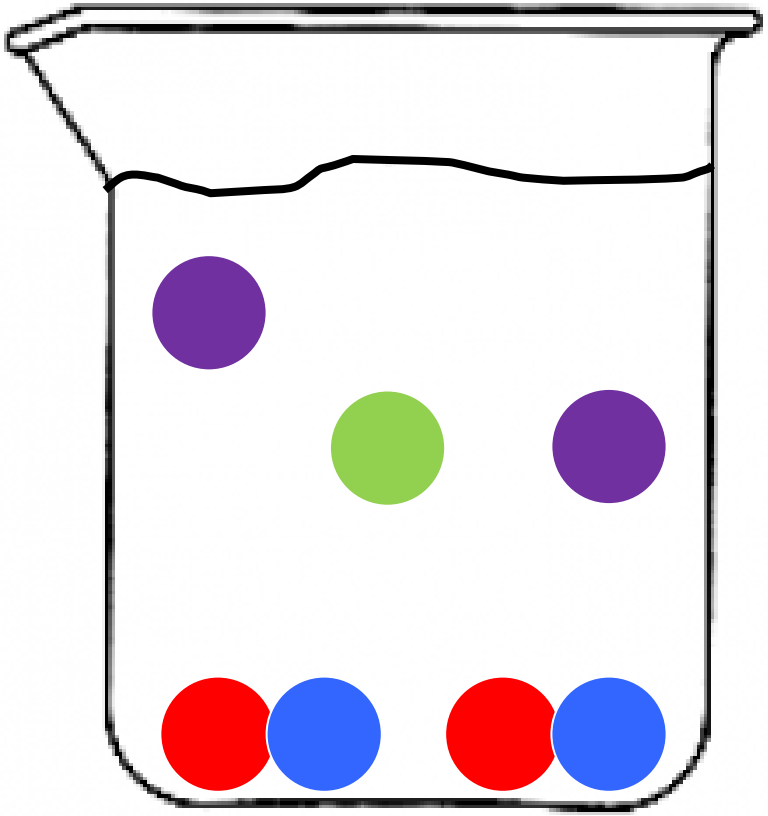

YouTube Link to Presentation

https://youtu.be/JwOuwkF568s