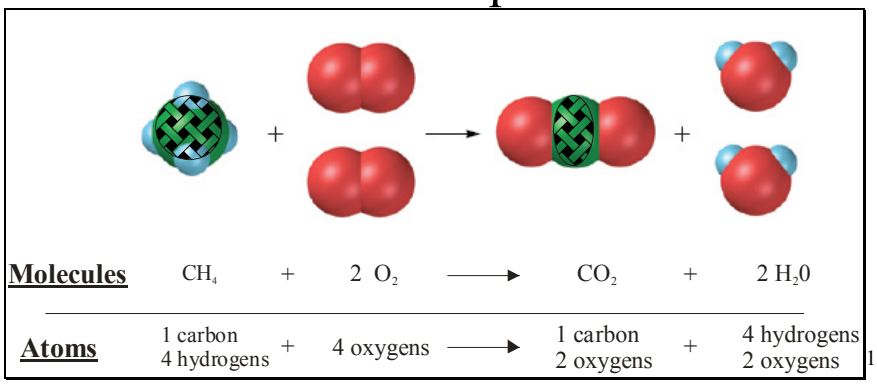
Chemical Equations



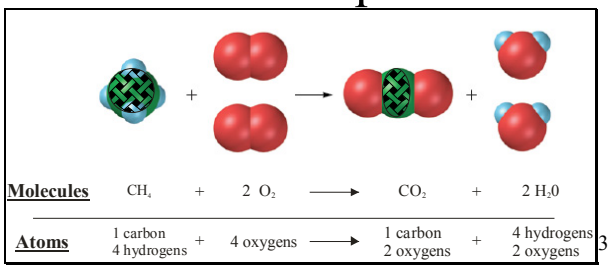
[1]

Symbols used in chemical equations

Symbol	Explanation[2]
	"Yields"; indicates result of reaction
	Used in place of a single arrow to indicate a reversible reaction
	A reactant or product in the solid state; also used to indicate a precipitate
	Alternative to (*s*), but used only to indicate a precipitate
	A reactant or product in the liquid state
	A reactant or product in an aqueous solution (dissolved in water)
	A reactant or product in the gaseous state
	Alternative to (*g*), but used only to indicate a gaseous product
	Reactants are heated
	Temperature at which reaction is carried out, in this case 0°C

[1] Taken from Modern Chemistry, by Davis, Frey, Sarquis, Sarquis; Holt, Rinehart & Winston (2006), p. 265.
[2] Ibid., p. 266.

Chemical Equations

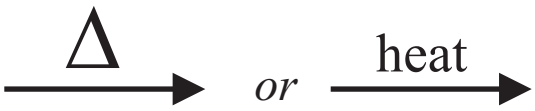


[3]

Symbols used in chemical equations

Symbol	Explanation[4]
→	"Yields"; indicates result of reaction
⇌	Used in place of a single arrow to indicate a reversible reaction
(s)	A reactant or product in the solid state; also used to indicate a precipitate
↓	Alternative to (*s*), but used only to indicate a precipitate
(l)	A reactant or product in the liquid state
(*aq*)	A reactant or product in an aqueous solution (dissolved in water)
(g)	A reactant or product in the gaseous state
↑	Alternative to (*g*), but used only to indicate a gaseous product
Δ → *or* heat →	Reactants are heated
O° C →	Temperature at which reaction is carried out, in this case 0°C

[3] Taken from Modern Chemistry, by Davis, Frey, Sarquis, Sarquis; Holt, Rinehart & Winston (2006), p. 265.
[4] Ibid., p. 266.

	*(top)* 	
		
(s)	*(top)* 	
(ℓ)		
(g)	(aq)	

	“Yields”; indicates result of reaction	Alternative to (*g*), but used only to indicate a gaseous product	
	Used in place of a single arrow to indicate a reversible reaction	Reactants are heated	
	A reactant or product in the solid state; also used to indicate a precipitate	Alternative to (*s*), but used only to indicate a precipitate	
	A reactant or product in the liquid state	Temperature at which reaction is carried out, in this case 0°C	
	A reactant or product in the gaseous state	A reactant or product in an aqueous solution (dissolved in water)	

Types of Chemical Reaction Sort Activity

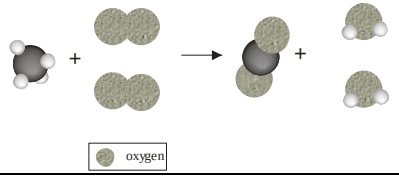
By Bruce Wellman

Script:

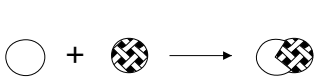
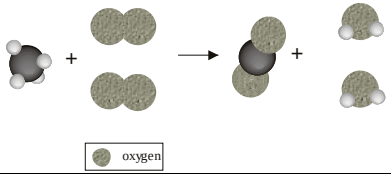
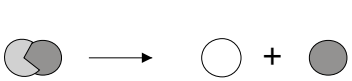
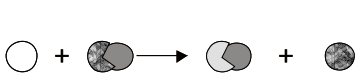
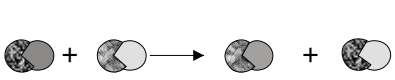
- Have the students clear everything off of their desks. Put that paper on the floor next to them. The CANNOT look at that paper for the first part of this activity
    - Have one person from each table come up and get a set of cards (one baggy) per person at their table.
    - Tell them to sort the cards by color and place them on the left side of their desks.
    - Have them turn the orange cards over and place them across the top of their desks (forming the head of 5 columns)
    - Have them take turns reading one of the names on the cards and giving a description of what they think the title means. Come to consensus as a group what each title means.
    - After a few minutes, ask the large group, "What does it mean to have something undergo combustion?" (the thing burns: needs to have oxygen to burn)
    - Have volunteers from the different group share out what each of the rest of the titles mean so the entire class has the same understanding.
    - Ask the large group: "Now, if you like using equations and math formulas pick up the green set of cards. If you like learning things visually, pick up the white cards." For the next step you need to place the set of cards you picked up (either green or white) and decide which column it should go in. Then do the other set of cards (either green or white) the same way. Once you have all of your <u>orange</u>, <u>green</u>, and <u>white</u> cards sorted, take turns sharing your choices with your group and come to consensus on what is the best placement of each card.
    - Check groups before they start writing down the info onto their sheets.
    - Have groups get some colored pencils and copy the info onto their summary sheets (they don't have to match the colors, just be consistent with what colors they use within the models)
    - Once the groups have copied all of the info onto their sheets, have them turn over the blue cards silently sort where they think the blue cards should go (have them keep all the other cards out so they are referring back to other images.) Have the group members share again and come to consensus on best placement (check their answers after that time but before they start copying down. Note that the $H_2 + O_2$ could be both a combustion and a synthesis but the best place for this sort is to put it under combustion)
    - Repeat for the yellow cards: after they reach consensus on the yellow cards, check with you, then have them copy that on their papers.
    - Students should then silently (individually) – do not collaborate (I want them to independently think about the analogies) on writing analogies for the rest of the reaction types.

If students finish early, have them take out a separate piece of paper and write out in long form (the full name of each of the compounds) each of the reactions on the blue and yellow cards.

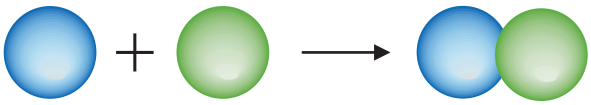
Some types of Chemical Reactions

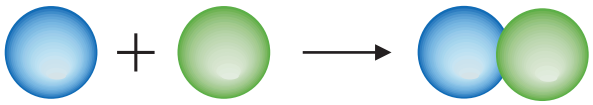
Orange cards	Synthesis	Combustion	Decomposition	Single Replacement Or Single Displacement	Double Replacement Or Double Displacement
Green	$A + B \rightarrow AB$				
White cards					
Blue cards			$NH_4NO_{3(s)} \xrightarrow{\Delta} N_2O_{(g)} + 2\,H_2O_{(g)}$		
Yellow cards					$KCN_{(aq)} + HBr_{(aq)} \rightarrow KBr_{(aq)} + HCN_{(g)}$
				A single guy goes to the dance and breaks up a couple and leaves with someone else's girlfriend	

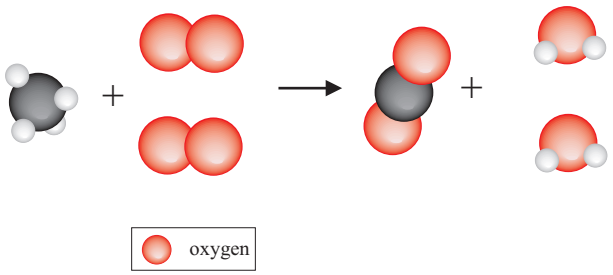
Some types of Chemical Reactions

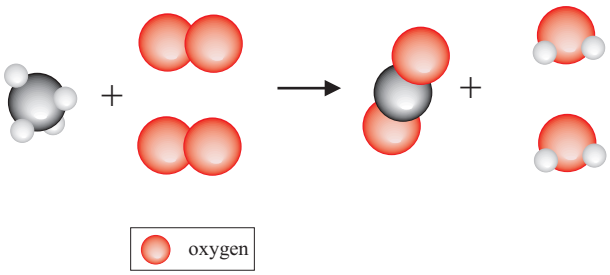
Synthesis	**Combustion**	**Decomposition**	**Single Replacement Or Single Displacement**	**Double Replacement Or Double Displacement**
$A + B \rightarrow AB$	$A + O_2 \rightarrow$	$AB \rightarrow A + B$	$A + BX \rightarrow AX + B$	$AX + BY \rightarrow AY + BX$
				
$2\,Fe_{(s)} + 3\,Cl_{2(g)} \rightarrow 2\,FeCl_{3(s)}$	$2\,H_{2(g)} + O_{2(g)} \rightarrow 2\,H_2O_{(g)}$	$NH_4NO_{3(s)} \xrightarrow{\Delta} N_2O_{(g)} + 2\,H_2O_{(g)}$	$2\,Li_{(s)} + 2\,H_2O_{(l)} \rightarrow 2\,LiOH_{(aq)} + H_{2(g)}$	$Ca(OH)_{2(aq)} + 2\,HCl_{(aq)} \rightarrow CaCl_{2(aq)} + 2\,H_2O_{(l)}$
$2\,K_{(s)} + I_{2(g)} \rightarrow 2\,KI_{(s)}$	$CH_{4(g)} + 2\,O_{2(g)} \rightarrow CO_{2(g)} + 2\,H_2O_{(g)}$	$2\,NaN_{3(s)} \xrightarrow{elect} 2\,Na_{(s)} + 3\,N_{2(g)}$	$Cu_{(s)} + 2AgNO_{3(aq)} \rightarrow 2\,Ag_{(s)} + Cu(NO_3)_{2(aq)}$	$KCN_{(aq)} + HBr_{(aq)} \rightarrow KBr_{(aq)} + HCN_{(g)}$
A boy and a girl go to a dance and leave as a couple.	*This is when things "burn".*	*A couple goes to a dance, break up and leave separately as singles.*	*A single guy goes to the dance and breaks up a couple and leaves with someone else's girlfriend*	*Two couples go to the dance and break up and leave with different dates.*

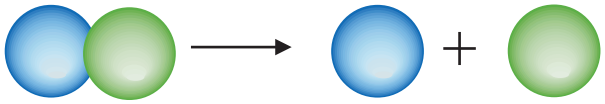
synthesis	synthesis
combustion	combustion
decomposition	decomposition
single replacement or single displacement	single replacement or single displacement
double replacement or double displacement	double replacement or double displacement

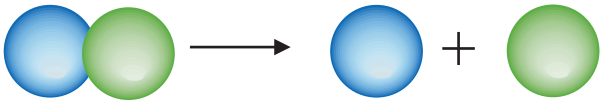





oxygen


oxygen





$A + B \rightarrow AB$	$A + B \rightarrow AB$
$A + O_2 \rightarrow$	$A + O_2 \rightarrow$
$AB \rightarrow A + B$	$AB \rightarrow A + B$
$A + BX \rightarrow AX + B$	$A + BX \rightarrow AX + B$
$AX + BY \rightarrow AY + BX$	$AX + BY \rightarrow AY + BX$

$2\ Fe_{(s)} + 3\ Cl_{2(g)} \longrightarrow 2\ FeCl_{3(s)}$	$2\ Fe_{(s)} + 3\ Cl_{2(g)} \longrightarrow 2\ FeCl_{3(s)}$
$2\ H_{2(g)} + O_{2(g)} \longrightarrow 2\ H_2O_{(g)}$	$2\ H_{2(g)} + O_{2(g)} \longrightarrow 2\ H_2O_{(g)}$
$NH_4NO_{3(s)} \xrightarrow{\Delta} N_2O_{(g)} + 2\ H_2O_{(g)}$	$NH_4NO_{3(s)} \xrightarrow{\Delta} N_2O_{(g)} + 2\ H_2O_{(g)}$
$2\ Li_{(s)} + 2\ H_2O_{(\ell)} \longrightarrow 2\ LiOH_{(aq)} + H_{2(g)}$	$2\ Li_{(s)} + 2\ H_2O_{(\ell)} \longrightarrow 2\ LiOH_{(aq)} + H_{2(g)}$
$Ca(OH)_{2(aq)} + 2\ HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + 2\ H_2O_{(\ell)}$	$Ca(OH)_{2(aq)} + 2\ HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + 2\ H_2O_{(\ell)}$

$2\ K_{(s)} + I_{2(g)} \longrightarrow 2\ KI_{(s)}$	$2\ K_{(s)} + I_{2(g)} \longrightarrow 2\ KI_{(s)}$
$CH_{4(g)} + 2\ O_{2(g)} \longrightarrow CO_{2(g)} + 2\ H_2O_{(g)}$	$CH_{4(g)} + 2\ O_{2(g)} \longrightarrow CO_{2(g)} + 2\ H_2O_{(g)}$
$2\ NaN_{3(s)} \xrightarrow{elect} 2\ Na_{(s)} + 3\ N_{2(g)}$	$2\ NaN_{3(s)} \xrightarrow{elect} 2\ Na_{(s)} + 3\ N_{2(g)}$
$Cu_{(s)} + 2\ AgNO_{3(aq)} \longrightarrow 2\ Ag_{(s)} + Cu(NO_3)_{2(aq)}$	$Cu_{(s)} + 2\ AgNO_{3(aq)} \longrightarrow 2\ Ag_{(s)} + Cu(NO_3)_{2(aq)}$
$KCN_{(aq)} + HBr_{(aq)} \longrightarrow KBr_{(aq)} + HCN_{(g)}$	$KCN_{(aq)} + HBr_{(aq)} \longrightarrow KBr_{(aq)} + HCN_{(g)}$