

BALANCING EQUATIONS NOTES

WHY DO WE NEED TO BALANCE CHEMICAL EQUATIONS?

The LAW OF CONSERVATION OF MASS says that matter cannot be created or destroyed. In other words, you cannot end up with any more or any less than you started with.

WHAT ARE "REACTANTS" & "PRODUCTS"?

In a chemical equation (eqn), reactants are on the left side of the arrow → products are on the right

HOW DO YOU BALANCE AN EQUATION?

1. Count up the number of atoms of each element (or polyatomic ion) on each side of the arrow in the eqn.
2. Use *coefficients* to balance the numbers on either side of the eqn.
3. Do not ever change subscripts (formulas) in a compound!

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EXAMPLE #1: ___ Na + ___ Br₂ → ___ NaBr

STEP 1: Set up a chart with # of atoms of each element on each side of eqn.

	Reactants	Products
Na	1	1
Br	2	1

STEP 2: Balance one of the elements that is not balanced. In this case, that is the Br.
(Reactant side has more than product side, so coefficient should go on the product side.)

___ Na + ___ Br₂ → 2 NaBr

* Reminder: the coefficient gets multiplied by subscripts of all elements in the compound it is in front of. *

	Reactants	Products
Na	1	2
Br	2	2

STEP 3: Check all elements to see if they are balanced. Na is not balanced, so it needs a coefficient of 2.

2 Na + ___ Br₂ → 2 NaBr

	Reactants	Products
Na	2	2
Br	2	2

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EXAMPLE #2: ___ HgO + ___ Cl₂ → ___ HgCl + ___ O₂

	R	P
Hg		
O		
Cl		

EXAMPLE #3: ___ CuCl₂ + ___ H₂S → ___ CuS + ___ HCl

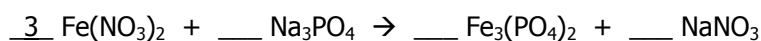
EXAMPLE #4: ___ Al₂O₃ → ___ Al + ___ O₂

EXAMPLE #5:

___ Fe(NO₃)₂ + ___ Na₃PO₄ → ___ Fe₃(PO₄)₂ + ___ NaNO₃

	reactants	products
Fe	1	3
NO ₃	2	1
Na	3	1
PO ₄	1	2

* because there is oxygen in every compound in the equation, it may be helpful to count the number of a polyatomic ion, rather than splitting the polyatomic ion into its elements and then counting.*



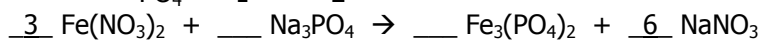
reactants | products

Fe 3 3

NO₃ 6 1

Na 3 1

PO₄ 1 2



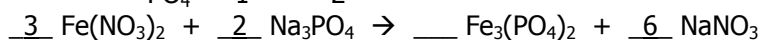
reactants | products

Fe 3 3

NO₃ 6 6

Na 3 6

PO₄ 1 2



reactants | products

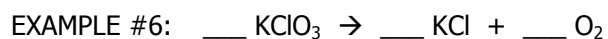
Fe 3 3

NO₃ 6 6

Na 6 6

PO₄ 2 2

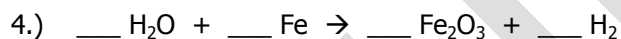
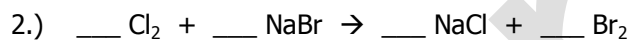
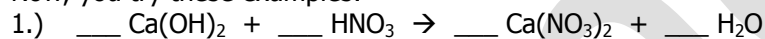
Finished!



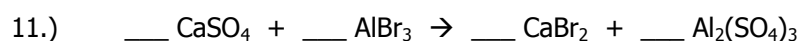
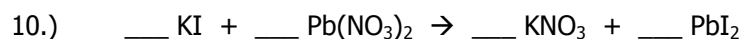
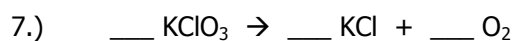
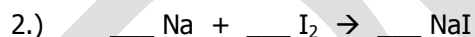
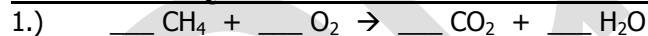
HINT: Balance the H's and O's last.



Now, you try these examples:



BALANCING EQUATIONS PRACTICE WORKSHEET

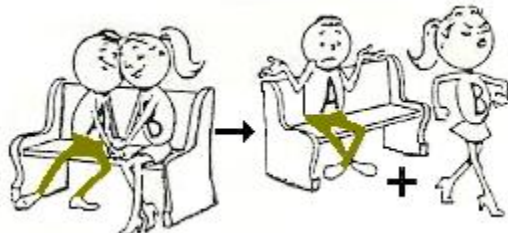


- 12.) $\text{___ H}_2\text{O}_2 \rightarrow \text{___ H}_2\text{O} + \text{___ O}_2$
- 13.) $\text{___ Na} + \text{___ H}_2\text{O} \rightarrow \text{___ NaOH} + \text{___ H}_2$
- 14.) $\text{___ C}_2\text{H}_6 + \text{___ O}_2 \rightarrow \text{___ CO}_2 + \text{___ H}_2\text{O}$
- 15.) $\text{___ Mg(NO}_3)_2 + \text{___ K}_3\text{PO}_4 \rightarrow \text{___ Mg}_3(\text{PO}_4)_2 + \text{___ KNO}_3$

TYPES OF EQUATIONS NOTES

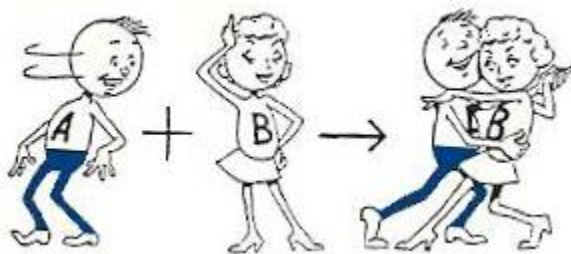
DECOMPOSITION: a compound breaks apart into simpler substances

* To recognize a DECOMPOSITION reaction, look for only 1 REACTANT. *



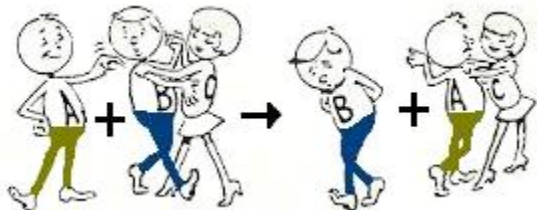
SYNTHESIS: 2 or more simple substances combine to form one compound; opposite of decomposition

* To recognize a SYNTHESIS reaction, look for only 1 PRODUCT. *



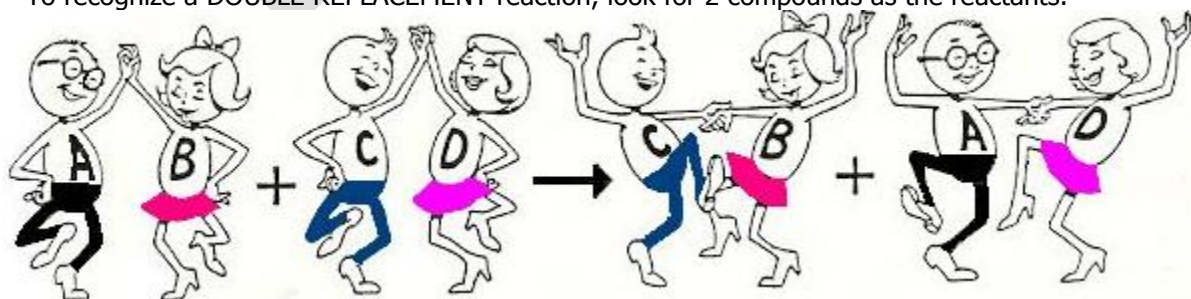
SINGLE REPLACEMENT: an element reacts with a compound to form a new element & a new compound

* To recognize a SINGLE REPLACEMENT reaction, look for one element and one compound as the reactants. *



DOUBLE REPLACEMENT: a compound reacts with another compound to form 2 new compounds

* To recognize a DOUBLE REPLACEMENT reaction, look for 2 compounds as the reactants. *



COMBUSTION: a hydrocarbon combines with oxygen to produce carbon dioxide and water

REACTION TYPES WORKSHEET

--> Balance each equation.

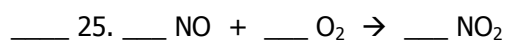
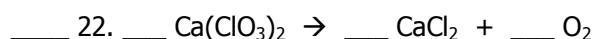
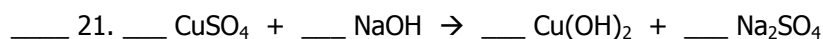
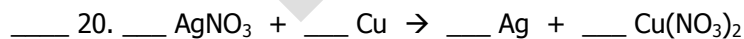
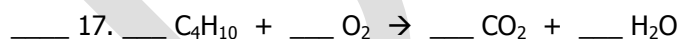
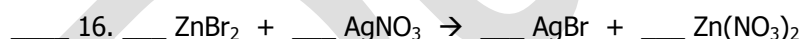
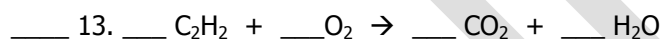
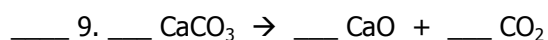
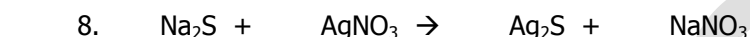
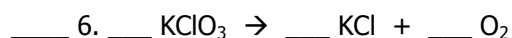
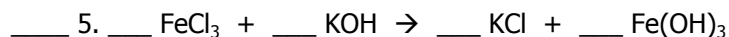
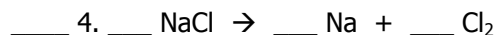
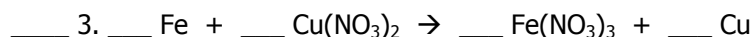
--> Identify the type of reaction as: * S - synthesis

* C – combustion

* SR - single replacement

* D - decomposition

* DR - double replacement

TYPE

PREDICTING WHETHER A SINGLE REPLACEMENT REACTION WILL OCCUR

The reactants in a single replacement reaction are an element (by itself) and a compound. Some single replacement reactions will happen, others will not. In order to determine if a single replacement reaction will occur, you must use the Activity Series. (It is located on page 7 of the Reference Tables.)

EXAMPLE 1 – Will the following reaction happen or not?

Step 1 – Look at the element by itself. Is this element a metal or a nonmetal? Al (aluminum) is a metal because it is located to the left side of the staircase line on the Periodic Table.

Step 2 – You will compare the type of element by itself to the similar type of element in the compound. In this case, aluminum is a metal, so I will compare it with the metal in the compound (which is Pb).

Step 3 – RULE: The element that is by itself must be HIGHER on (closer to the top of) the Activity Series for the reaction to happen! In this case...

Al	(by itself)	
Mn		
Zn		
Cr		
Fe		
Cd		Replace hydrogen from steam
Co		
Ni		
Sn		
Pb	(in compound)	

Aluminum (Al) is higher than lead (Pb), so the reaction happens.

EXAMPLE 2 – Will the following reaction happen or not?

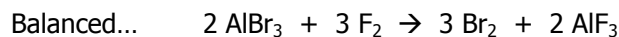
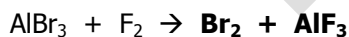
Answer: Iron (Fe) needs to be higher on the Activity Series than magnesium (Mg) in order for the reaction to occur. It is not, so there is no reaction.

EXAMPLE 3 – Will the following reaction happen or not?

Answer: Br₂ is the element by itself. It is a nonmetal, so I have to compare it to the nonmetal in the compound – which is Cl. Br needs to be higher than Cl in order for the reaction to happen. It is not, so there's no reaction.

EXAMPLE 4 – Will the following reaction happen or not?

Answer: F₂ is the element by itself. It is a nonmetal, so I have to compare it to the nonmetal in the compound – which is Br. F needs to be higher than Br in order for the reaction to happen. It is, so the reaction happens. Fluorine and bromine "switch places". Remember to use the oxidation numbers of the elements to write the formulas. Also, remember that fluorine, chlorine, bromine, and iodine are DIATOMIC – that means that these elements will have a subscript of 2 when they are by themselves.



EXAMPLES:

1. $\text{Al} + \text{NiBr}_2 \rightarrow$
2. $\text{Fe}_2(\text{SO}_4)_3 + \text{Ag} \rightarrow$
3. $\text{NaCl} + \text{F}_2 \rightarrow$
4. $\text{Ba}(\text{NO}_3)_2 + \text{Ni} \rightarrow$
5. $\text{I}_2 + \text{AlBr}_3 \rightarrow$

6. $\text{Ca} + \text{KCl} \rightarrow$
 7. $\text{Mg} + \text{Zn}_3(\text{PO}_4)_2 \rightarrow$
 8. $\text{Na} + \text{SnCO}_3 \rightarrow$

Unit 8 Review Worksheet (Standard level)

- (A) Write the formula(s) for the products of the reaction (if they are not already given).
 (B) Balance the equation.
 (C) Tell the type of reaction.

	Reactants		Products	Type of Equation
1.	silver nitrate + sodium chloride $__ \text{AgNO}_3 + __ \text{NaCl}$	\rightarrow	$__ \text{AgCl} + __ \text{NaNO}_3$	
2.	ammonium sulfide + barium nitrate $__ (\text{NH}_4)_2\text{S} + __ \text{Ba}(\text{NO}_3)_2$	\rightarrow	$__ \text{NH}_4\text{NO}_3 + __ \text{BaS}$	
3.	lithium carbonate $__ \text{Li}_2\text{CO}_3$	\rightarrow	$__ \text{Li}_2\text{O} + __ \text{CO}_2$	
4.	zinc + sulfur $__ \text{Zn} + __ \text{S}$	\rightarrow	$__ \text{ZnS}$	
5.	potassium + chlorine $__ \text{K} + __ \text{Cl}_2$	\rightarrow	$__ \text{KCl}$	
6.	magnesium nitride $__ \text{Mg}_3\text{N}_2$	\rightarrow	$__ \text{Mg} + __ \text{N}_2$	
7.	aluminum + copper (II) sulfate $__ \text{Al} + __ \text{CuSO}_4$	\rightarrow		
8.	aluminum + iron (III) bromide $__ \text{Al} + __ \text{FeBr}_3$	\rightarrow		
9.	bromine + silver chloride $__ \text{Br}_2 + __ \text{AgCl}$	\rightarrow		
10.	zinc + nickel (II) nitrate $__ \text{Zn} + __ \text{Ni}(\text{NO}_3)_2$	\rightarrow		
11.	magnesium + silver sulfate $__ \text{Mg} + __ \text{Ag}_2\text{SO}_4$	\rightarrow		
12.	potassium sulfate + aluminum chlorate $__ \text{K}_2\text{SO}_4 + __ \text{Al}(\text{ClO}_3)_3$	\rightarrow	$__ \text{KClO}_3 + __ \text{Al}_2(\text{SO}_4)_3$	
13.	ethane (C_2H_6) + oxygen $__ \text{C}_2\text{H}_6 + __ \text{O}_2$	\rightarrow		
14.	copper (II) chloride + sodium phosphate $__ \text{CuCl}_2 + __ \text{Na}_3\text{PO}_4$	\rightarrow	$__ \text{Cu}_3(\text{PO}_4)_2 + __ \text{NaCl}$	

15.	calcium bicarbonate $\underline{\quad} \text{Ca}(\text{HCO}_3)_2$	→	$\underline{\quad} \text{CaO} + \underline{\quad} \text{CO}_2 + \underline{\quad} \text{H}_2\text{O}$	
16.	strontium nitrate + copper (II) sulfate $\underline{\quad} \text{Sr}(\text{NO}_3)_2 + \underline{\quad} \text{CuSO}_4$	→	$\underline{\quad} \text{SrSO}_4 + \underline{\quad} \text{Cu}(\text{NO}_3)_2$	
17.	magnesium acetate + iron (III) carbonate $\underline{\quad} \text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2 + \underline{\quad} \text{Fe}_2(\text{CO}_3)_3$	→	$\underline{\quad} \text{MgCO}_3 + \underline{\quad} \text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_3$	
18.	copper (II) phosphate + zinc $\underline{\quad} \text{Cu}_3(\text{PO}_4)_2 + \underline{\quad} \text{Zn}$	→		
19.	potassium + HCl $\underline{\quad} \text{K} + \underline{\quad} \text{HCl}$	→		
20.	calcium + potassium chlorate $\underline{\quad} \text{Ca} + \underline{\quad} \text{KClO}_3$	→		