

1. What are indications of a chemical reaction?
Color change, precipitate, gas production, energy
2. What are the six types of chemical reactions provide an example of each?

Decomposition: $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$ (always 1 reactant)

Synthesis/Combination: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ (always 1 product)

Combustion: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ (always CH compound & Oxygen to always produce CO_2 & H_2O)

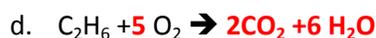
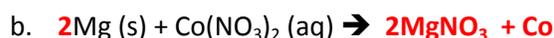
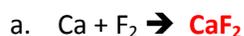
Single Replacement: $\text{Sr} + 2\text{AgCl} \rightarrow \text{SrCl}_2 + 2\text{Ag}$ (activity series; metal replaces metal, nonmetal replaces nonmetal)

Double Replacement: $\text{KCl} + \text{NaBr} \rightarrow \text{NaCl} + \text{KBr}$ (two ionic compounds, metals switch places)

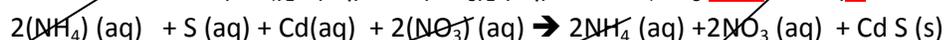
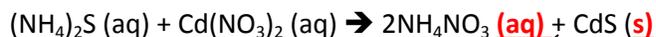
Acid-Base: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{HOH}$ (acid ($\text{H} 1^{\text{st}}$) and base (hydroxide present) to produce water and ionic compound)

3. Discuss the following:
 - a. law of conservation of matter : **matter cannot be created nor destroyed(total mass of reactants = total mass of products)**
 - b. aqueous : **soluble homogeneous mixture (a solution) in which cations and anions have separated in water**
 - c. precipitate : **insoluble; solids formed from two liquids**
 - d. soluble vs insoluble : **soluble= cations break apart from anions in water insoluble= solids formed**
 - e. activity series : **used to determine if an element is more reactive. It determines if a single replacement reaction will proceed or if it is a no reaction.**
 - f. endothermic reaction : **adding heat, absorbing heat, heat is needed, heat is on the reactant side, the enthalpy is positive**
 - g. exothermic reaction : **removing heat, heat is given off, heat is produced, heat is on the product side, the enthalpy is negative**

4. Determine the type of reaction, predict the products , and balance the reaction:



5. What is the net ionic reaction for the following: $(\text{NH}_4)_2\text{S} (\text{aq}) + \text{Cd}(\text{NO}_3)_2 (\text{aq}) \rightarrow 2\text{NH}_4\text{NO}_3 (?) + \text{CdS} (?)$



6. How much of Chlorine gas is needed in grams to produce 0.75 moles of sodium chloride: $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

0.75 moles NaCl	1 mole Cl_2	70.90 g Cl_2	$= 53.175 \text{ g Cl}_2 =$	53 g Cl_2
	1 mole NaCl	1 mole Cl_2		

Mole ratio

*Molar mass of
Diatomic chlorine*

*Round to 2
significant figures*

7. How much carbon dioxide is produced in liters assume STP when 25.0 g of calcium carbonate decomposes: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

25.0 g CaCO_3	1 mole CaCO_3	1 mole CO_2	22.4 L CO_2	$= 5.59 \text{ L CO}_2$
	100.09 g CaCO_3	1 mole CaCO_3	1 mole CO_2	

*Molar mass of
Calcium carbonate*

mole ratio

*molar volume
only @ STP*

*Round to 3
significant figures*

8. What is the max amount of aluminum chloride produced in grams when 4.25×10^{22} atoms of aluminum react with 18.23 grams of chlorine gas? What is the limiting reactant? What is the excess reactant? What is the percent yield if 17.48 g of aluminum chloride is produced in lab? $2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$

$4.25 \times 10^{22} \text{ atoms Al}$	1 mole Al	2 mole AlCl_3	133.33 g AlCl_3	$= 9.41 \text{ g AlCl}_3$
	$6.02 \times 10^{23} \text{ atoms Al}$	2 mole Al	1 mole AlCl_3	

18.23 g Cl_2	1 mole Cl_2	2 mole AlCl_3	133.33 g AlCl_3	$= 22.85 \text{ g AlCl}_3$
	70.90 g Cl_2	3 mole Cl_2	1 mole AlCl_3	

*Max amount (theoretical
yield) = smallest answer of
the two grids*

Limiting reactant: **Aluminum**

Excess reactant: **Chlorine**

*Wow! Percent yield > 100%.
There must be lots of
experimental error.*

$$\text{Percent error} = \frac{(17.48 \text{ g} - 9.41 \text{ g})}{9.41 \text{ g}} \times 100 = 85.76\% \text{ error}$$

$\frac{\text{Actual}}{\text{Theoretical}}$	$\frac{17.48 \text{ g}}{9.41 \text{ g}}$	$= 185.76 \%$
--	--	---------------

9. How much energy is associated with this reaction when there is 4.00 grams of hydrogen reacts with excess carbon? $\text{C}(\text{s}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + 74.3 \text{ kJ}$

4.00 g H_2	1 mole H_2	-74.3 kJ	$= -73.6 \text{ kJ}$
	2.02 g H_2	2 mole H_2	

10. If 67.4 kJ is used in the reaction between hydrogen and carbon dioxide, how many liters of carbon monoxide can be produced at STP? $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) + 11 \text{ kJ} \rightarrow \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$

67.4 kJ	1 mole CO	22.4 L CO	$= 137 \text{ L CO}$
	11 kJ	1 mole CO	