LESSON 93

CLASSWORK

Name _____

Date _____ Period _____

Get the Lead Out

Limiting Reactant and Percent Yield

Purpose

To determine what limits the amount of product made.

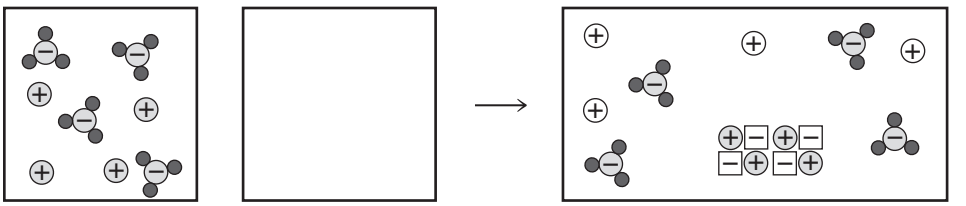
Part 1: Thallium Removal

1. Consider the reaction to remove thallium from a water source through precipitation.

$TlNO_3(aq) + NaCl(aq) \longrightarrow TlCl(s) + NaNO_3(aq)$

a. Complete the middle box to show the correct amount of sodium chloride needed to react with the thallium nitrate in the first box.

Key: Tl^+ ⊕ NO_3^-  Na^+ ⊕ Cl^- ⊖



b. Circle the solid thallium chloride in the products box.

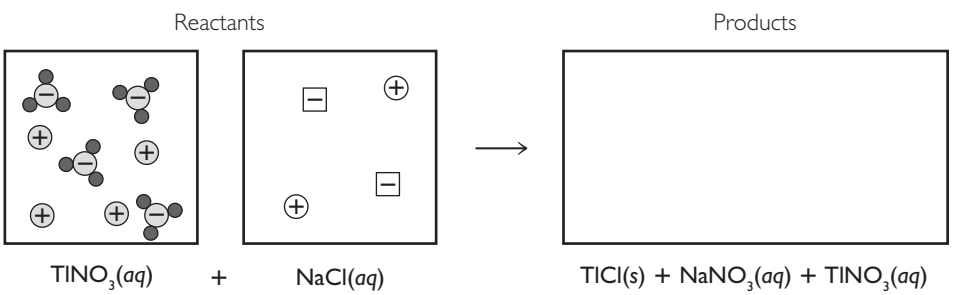
c. What else is present in the beaker at the end of the reaction, besides the solid TlCl?

d. Why aren't any thallium ions left over at the end?

2. Consider the same reaction, with different amounts of reactants.

a. Complete the drawing in the final box to show how many products can be created using the reactants shown in the first two boxes. Circle the thallium chloride.

Key: Tl^+ ⊕ NO_3^-  Na^+ ⊕ Cl^- ⊖



b. Which reactant limited the amount of thallium chloride?

c. What is present in the beaker at the end of the reaction?

d. If you started with 3 moles of thallium nitrate and 2 moles of sodium chloride, what would be left in the beaker after the reaction?

3. Complete the table to show how many moles of thallium chloride are formed using the amounts listed. Identify the limiting reactant for each combination of reactants.

Reaction	Reactants	Grams of reactant dissolved in water	Moles of reactant	Maximum amount of TlCl produced	Limiting reactant
1	$TlNO_3$	26.6 g	0.10 mol	0.10 mol	none
	NaCl	5.85 g	0.10 mol		
2	$TlNO_3$	26.6 g	0.10 mol	0.01 mol	NaCl
	NaCl	0.585 g	0.010 mol		
3	$TlNO_3$	26.6 g	0.10 mol		
	NaCl	58.5 g			
4	$TlNO_3$	11.17 g			NaCl
	NaCl	1.23 g			

Part 2: Lead Removal

1. Lead ions can be removed from a water supply by adding sodium chloride. Balance the chemical equation for this reaction:

$$Pb(NO_3)_2(aq) + NaCl(aq) \longrightarrow PbCl_2(s) + NaNO_3(aq)$$

2. How many moles of NaCl do you need for every mole of $Pb(NO_3)_2$ in the water?

3. Making Sense Describe how to determine whether 234 g of NaCl is enough to remove 662 g of dissolved $Pb(NO_3)_2$ from a water supply.