Limiting Reagent Walk-Through – 2nd Method

|  |
| --- |
| **Al(OH)3 + 3NaCl 🡪 AlCl3 + 3NaOH *You start with 28.50 g of Al(OH)3 and 65.00g of NaCl*** |
| ***How many grams of NaOH can you make, and how many moles of the excess (XS) reagent do you have left when done?*** |

**STEP #1 – Calculate theoretical product with 1st reactant**

*Use mole highway*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 28.50 g Al(OH)3 | 1 mol Al(OH)3 | 3 mol NaOH | 40.00g NaOH | = 43.85 g NaOH |
|  | 78.00 g Al(OH)3 | 1 mol Al(OH)3 | 1 mol NaOH |  |

**STEP #2 – Calculate theoretical product with 2nd reactant**

*Use mole highway*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 65.00 g NaCl | 1 mol NaCl | 3 mol NaOH | 40.00g NaOH | = 44.49 g NaOH |
|  | 58.44 g NaCl | 3 mol NaCl | 1 mol NaOH |  |

**STEP #3 – Determine Limiting Reagent**

*The smaller amount of product produced tells you which reactant you will run out of first.*

Al(OH)3 = 43.85 g NaOH

NaCl = 44.49 g NaOH

Al(OH)3 produces less NaOH therefore it is the limiting reagent.  
NaCl is therefore the excess reagent.

**STEP #4 - Dimensional Analysis with Limiting Reagent**

*Convert from moles of limiting reactant to desired unit of unknown substance asked for in the problem – use mole highway to determine where to start and end. If it is asking for grams then you already did this in Step #1 or Step #2 depending on the question being asked*

Al(OH)3 + 3NaCl 🡪 AlCl3 + 3NaOH  
LR XS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 28.50 g Al(OH)3 | 1 mol Al(OH)3 | 3 mol NaOH | 40.00g NaOH | = 43.85 g NaOH |
|  | 78.00 g Al(OH)3 | 1 mol Al(OH)3 | 1 mol NaOH | made during   the reaction |

**STEP #5 - XS Left: Dimensional Analysis and then Subtract**

*Use amount of Limiting Reagent and mole highway to calculate how many grams of Excess Reagent are used up during the reaction:*

Al(OH)3 + 3NaCl 🡪 AlCl3 + 3NaOH  
LR XS

28.50g 65.00g

Al(OH)3 NaCl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 28.50 g Al(OH)3 | 1 mol Al(OH)3 | 3 mol NaCl | 58.44 g NaCl | = 64.06 g NaCl |
|  | 78.00 g Al(OH)3 | 1 mol Al(OH)3 | 1 mol NaCl | used in rxn |

*Subtract grams of Excess Reagent you used from the amount of Excess Reagent you started with to determine how much is left over.*

65.00 g of NaCl when reaction started

– 64.06 g of NaCl used during the rxn

= 0.94 g of NaCl left over

**STEP #6 - XS Left: Convert to desired unit if needed**

*Use mole highway*

|  |  |  |
| --- | --- | --- |
| 0.94 g NaCl left over | 1 mol NaCl | = 0.01608 mol of NaCl left over |
|  | 58.44 g NaCl |  |