

Limiting Reactants

Limiting Reactant (LR) - reactant this is used up 1st in a reaction, controls amount of product made

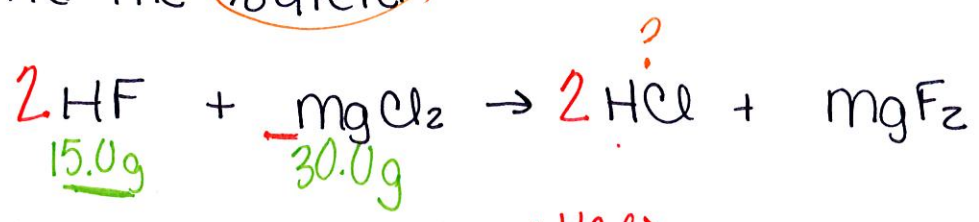
Excess Reactant (ER) - all the other reactants

Actual Yield (AY) - amount of product produced in reality

Theoretical Yield (TY) - amount of product stoichiometry says we should produce

$$\% \text{ yield} = \frac{\text{AY}}{\text{TY}} \times 100$$

Ex) ^{Given 1} 15.0g of hydrofluoric acid ^{HF} reacts with ^{Given 2} 30.0g of magnesium chloride in the reaction below. Determine the ~~LR~~, ~~ER~~, the ~~TY~~ of hydrochloric acid and if ^{AY} 18.0g of hydrochloric acid are actually produced, find the % yield.



15.0g HF $\left(\frac{1 \text{ mol HF}}{20.01 \text{ g HF}} \right) \left(\frac{2 \text{ mol HCl}}{2 \text{ mol HF}} \right) = .750 \text{ mol HCl}$

1.01g
+ 19.00g

30.0g MgCl₂ $\left(\frac{1 \text{ mol MgCl}_2}{95.21 \text{ g MgCl}_2} \right) \left(\frac{2 \text{ mol HCl}}{1 \text{ mol MgCl}_2} \right) = .630 \text{ mol HCl}$

24.31
- 20.90
95.21

36.46g HCl
1 mol HCl

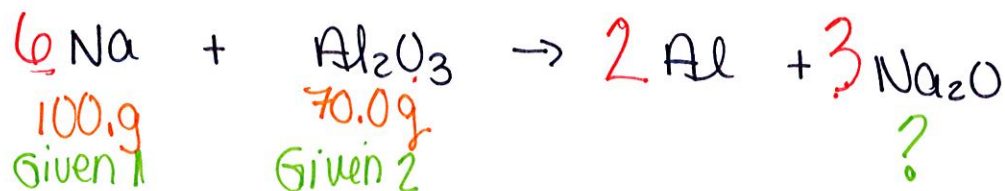
smallest amount

LR = MgCl₂
ER = HF

TY = 23.0g HCl

$\% \text{ yield} = \frac{18.0 \text{ g}}{23.0 \text{ g}} \times 100 = 78.3 \%$

Ex) 100.0g of sodium reacts with 70.0g of aluminum oxide in the reaction below. Determine the LR, ER, and the TY of sodium oxide. If 75.0g of sodium oxide is produced in lab, find the % yield.



$$100.0\text{g Na} \left(\frac{1 \text{ mol Na}}{22.99\text{g Na}} \right) \left(\frac{3 \text{ mol Na}_2\text{O}}{6 \text{ mol Na}} \right) = 2.17 \text{ mol Na}_2\text{O}$$

$$70.0\text{g Al}_2\text{O}_3 \left(\frac{1 \text{ mol Al}_2\text{O}_3}{101.96\text{g Al}_2\text{O}_3} \right) \left(\frac{3 \text{ mol Na}_2\text{O}}{1 \text{ mol Al}_2\text{O}_3} \right) = 2.06 \text{ mol Na}_2\text{O} \left(\frac{61.98\text{g Na}_2\text{O}}{1 \text{ mol Na}_2\text{O}} \right)$$

smaller

- ① LR = Al_2O_3
 ② ER = Na

③ TY = $128\text{g Na}_2\text{O}$
 ④ % yield = $\frac{\text{AY}}{\text{TY}} \times 100$

$$= \frac{75.0\text{g}}{128} \times 100 = \boxed{58.6\%}$$