SAMPLE PROBLEM : % REACTION

Find the % reaction and write the expression if 6.90 g of $H_{2(g)}$ and 32.0 g of $O_{2(g)}$ react to form 25.75 g of ice at - 70 C°.

$$2H_{2(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(s)}$$

init. 6.90 g 32.0 g —

eqm. 25.75 g

$$\%\,rxn = \frac{exp.}{theor.} \times 100\%$$

exp. @ eqm.

theor. max. → stoichiometry

Find max. product :

If H_2 is L.R. :

$$6.90\,g\,H_2 \times \frac{1\,mol\,H_2}{2.02\,g\,H_2} \times \frac{2\,mol\,H_2O}{2\,mol\,H_2} \times \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} = 61.55\,g\,H_2O$$

If O_2 is L.R. :

$$32.0\,g\,O_2 \times \frac{1\,mol\,O_2}{32.00\,g\,O_2} \times \frac{2\,mol\,H_2O}{1\,mol\,O_2} \times \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} = 36.04\,g\,H_2O$$

O_2 is L.R.

$$\%\,rxn = \frac{exp.}{theor.} \times 100\%$$

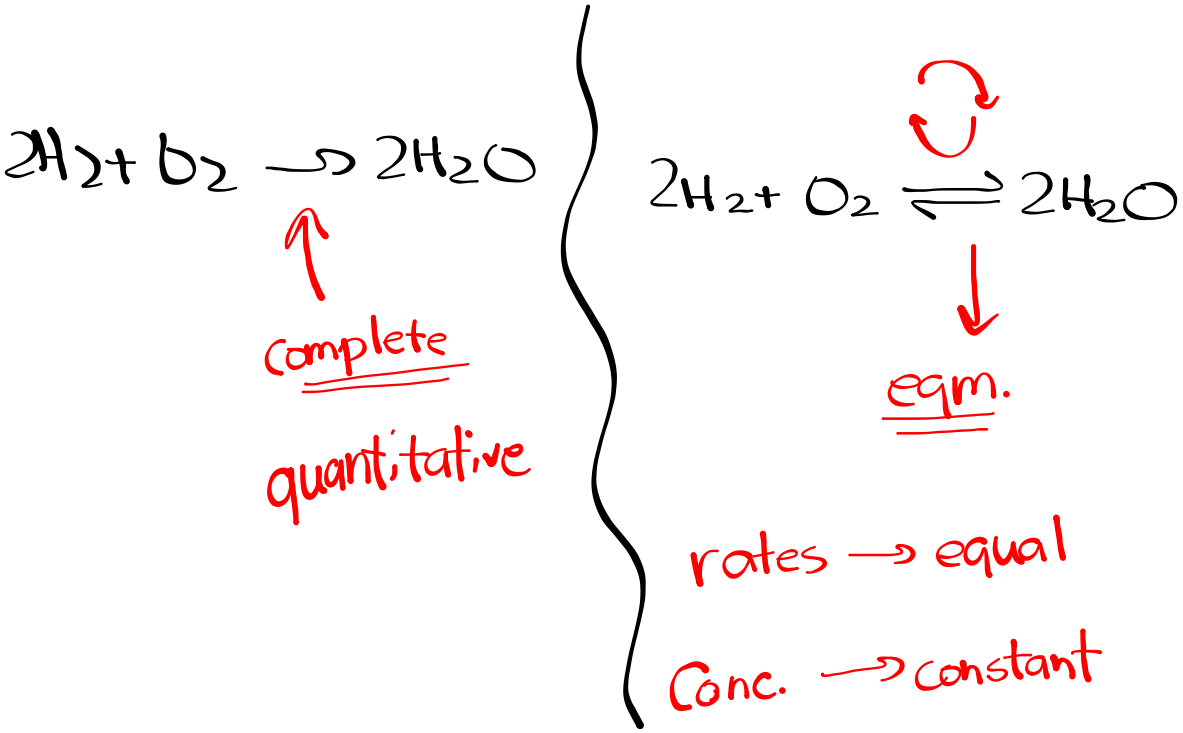
$$\%\,rxn = \frac{25.75\,g}{36.04\,g} \times 100\%$$

$\%\,rxn = 71.4\%$

PRODUCTS - FAVOURED

71.4%

$$2H_{2(g)} + O_{2(g)} \rightleftharpoons 2H_2O_{(s)}$$


2H2 + O2 → 2H2O
complete
quantitative
2H2 + O2 ⇌ 2H2O
eqm.
rates → equal
Conc. → constant

Chemical Equilibrium

Reversible Reaction

Reaction in which both the forward and reverse processes are occuring simultaneously.

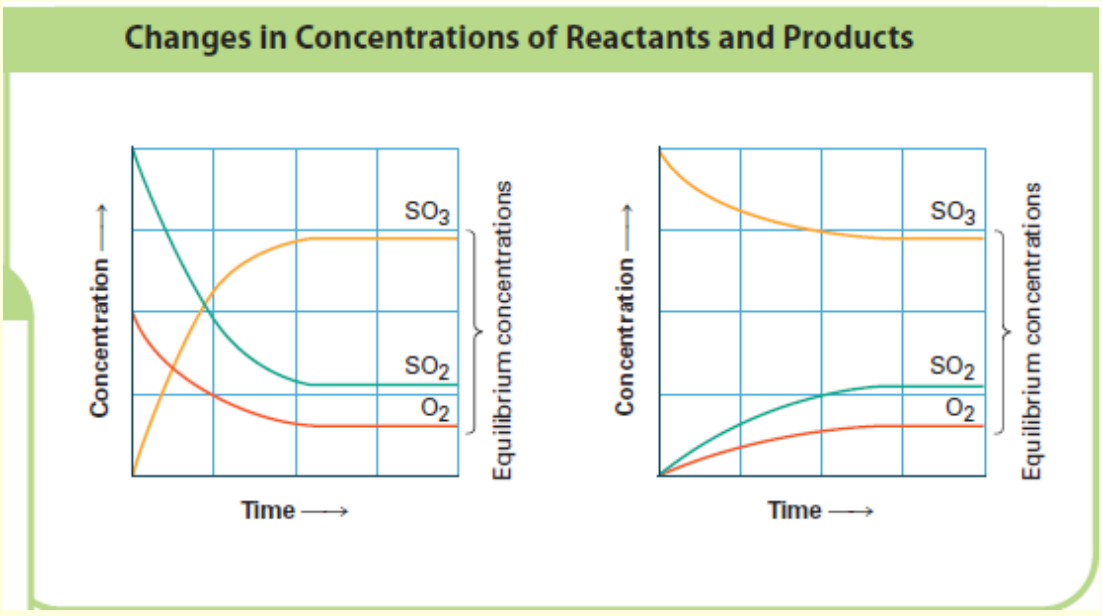
$$A + B \rightleftharpoons C$$

Chemical equilibrium

A system is said to have reached chemical equilibrium when the forward and reverse reactions are occuring at the same rate.

⟶ no net change occurs in the concentration of components of the system

http://www.chm.davidson.edu/ronutt/che115/EquKin/EquKin.htm



Percent Reaction

Percent Reaction (percent yield) - is the amount of product measured at equilibrium compared with the maximum possible amount of product.

Equilibrium position
relative concentration of reactants and products at equilibrium
⇒0 % indicates no product formed
⇒100 % indicates the maximum possible product formed

- maximum amount of possible product is found using stoichiometry, assuming a forward reaction with no reverse reaction.

$$\% \text{ reaction} = \frac{\text{Experimental yield}}{\text{Theoretical yield (maximum)}} \times 100\ \%$$

Classifying Chemical Equilibria

< 50 % - reactants favored
> 50 % - products favored
> 99 % - quantitative

The equilibrium position of the reaction is indicated in the following manner :

$$\text{Ex.} H_{2(g)} + I_{2(g)} \overset{78\%}{<==>} 2HI_{(g)} \quad t = 448^{o}$$

Indicates that 78 % of the total amount of HI possible is produced at 448°C. Therefore this is a **product** favored reaction.

Limiting Reagent

In a chemical reaction, the reactant that will "run out" first is called the **limiting reagent**.
The other reactant is called the **excess reagent**.

$$2NH_3 + 3CuO \longrightarrow N_2 + 3Cu + 3H_2O$$

18.1 g **90.4 g**