

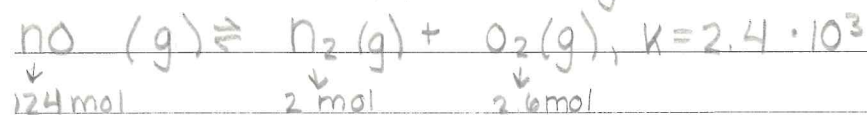
a.  $Q = \frac{[CO_2][H_2]}{[CO][H_2O]} \rightarrow \frac{2 \cdot 2}{1} = 4 > \text{greater than } K, \text{ which is } 1, \text{ so}$

it is product favored and shifts left

ii. If  $Q < K$ , reaction goes to right

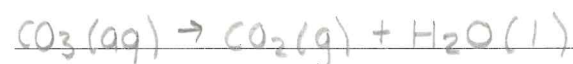
iii. If  $Q = K$ , equilibrium

iiii. If  $Q > K$ , reaction goes to left

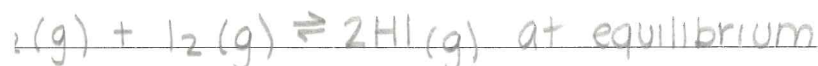


$Q = \frac{[N_2][O_2]}{[NO]^2} \rightarrow \frac{(2)(2.6)}{(124)^2} = 9028, Q > K \text{ reaction shifts left}$

Chatelier's Principle



If a system at equilibrium undergoes stress, it will respond to overcome the effect of the stress



Add a reactant, equilibrium shifts to the right

Remove product, equilibrium shifts to the right

Add product, equilibrium shifts to left

Remove reactant, equilibrium shifts to left



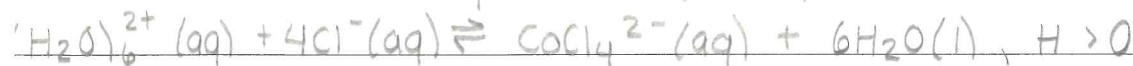
Higher volume/less pressure favors side with more moles

Less volume/more pressure favors side with less moles

Changes in Temperature

Endothermic heat is a reactant ( $+\Delta H$ )

Exothermic heat is a product ( $-\Delta H$ )



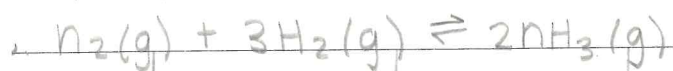
1. Ice, shifts left

2. Heat, shifts right

Exothermic Reactions

On ice, shifts right

? Heat, shifts left



|                    | Left | Right |
|--------------------|------|-------|
| add $\text{N}_2$   |      | x     |
| add $\text{NH}_3$  | x    |       |
| decrease<br>volume |      | x     |
| add $\text{O}_2$   |      |       |
| increase<br>temp   | x    |       |

→ nothing!