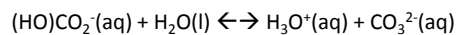
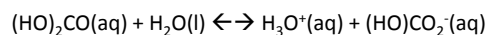
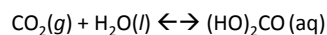


## Carbonic acid equilibria

CH101 Fall 2009  
Boston University

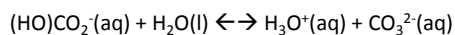
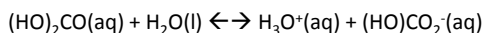
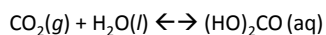
## Carbonic acid equilibria

Three *connected reactions* ...



... that establish *simultaneous balance*.

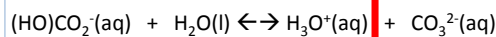
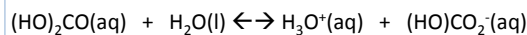
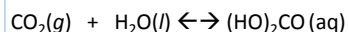
## Effect of acidity on $\text{CO}_2(g)$ solubility



Adding *acid*, *lowers solubility* of  $\text{CO}_2(g)$  in water.  
Adding *base*, *increases solubility* of  $\text{CO}_2(g)$  in water.  
Response of system illustrates *Le Chatelier's principle*

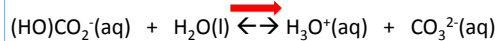
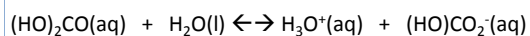
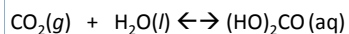
## Adding NaOH

... *disturbs balance* by consuming  $\text{H}_3\text{O}^+$



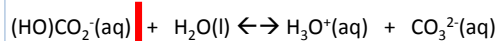
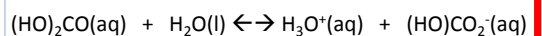
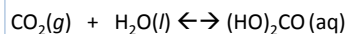
## Adding NaOH

... which shifts balance toward *more products*



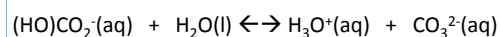
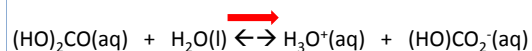
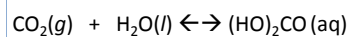
## Adding NaOH

... which *consumes*  $(\text{HO})\text{CO}_2^{2-}$



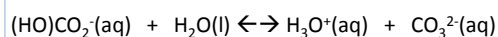
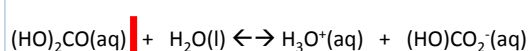
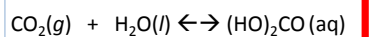
## Adding NaOH

... which shifts balance toward *more products*



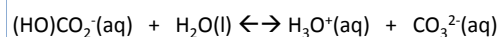
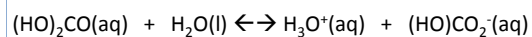
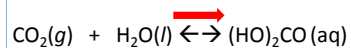
## Adding NaOH

... which *consumes*  $(\text{HO})_2\text{CO}$



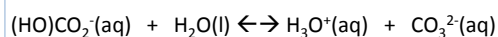
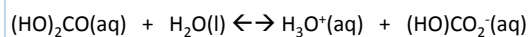
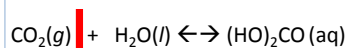
## Adding NaOH

... which shifts balance toward *more products*



## Adding NaOH

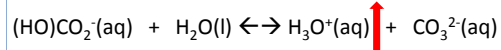
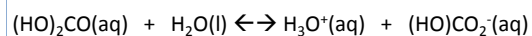
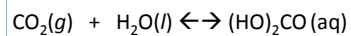
... which *consumes*  $\text{CO}_2$



... and so *balance is restored*.

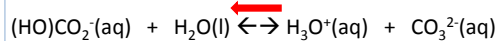
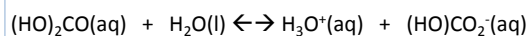
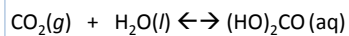
## Adding HCl

... *disturbs balance* by increasing  $\text{H}_3\text{O}^+$

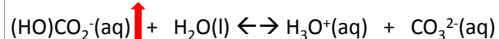
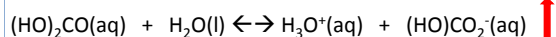
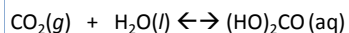


## Adding HCl

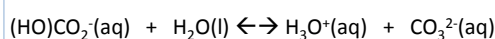
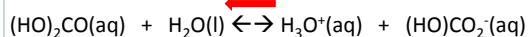
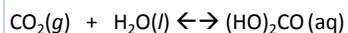
... which shifts balance toward *more reactants*



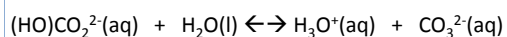
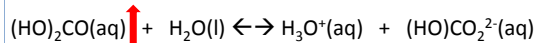
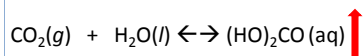
## Adding HCl

... which forms *more*  $(\text{HO})\text{CO}_2^-$ 

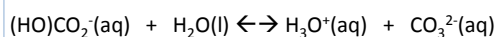
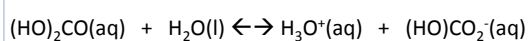
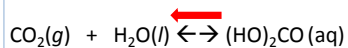
## Adding HCl

... which shifts balance toward *more reactants*

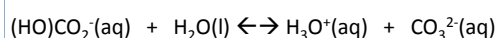
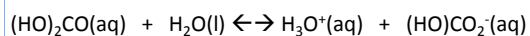
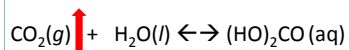
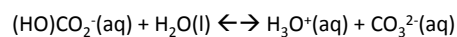
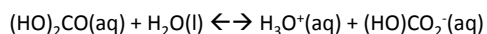
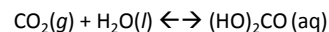
## Adding HCl

... which forms *more*  $(\text{HO})_2\text{CO}$ 

## Adding HCl

... which shifts balance toward *more reactants*

## Adding HCl

... which *forms more*  $\text{CO}_2$ ... and so *balance is restored*Effect of acidity on  $\text{CO}_2(g)$  solubility

Adding *acid*, *lowers solubility* of  $\text{CO}_2(g)$  in water.  
 Adding *base*, *increases solubility* of  $\text{CO}_2(g)$  in water.  
 Response of system illustrates *Le Chatelier's principle*