Announcements – Lecture XV – Tuesday, Oct 28h

1. **Fourth Lab – Saturday, November 1st … 1-4pm … ISB 155/160 (A-E)**

   a) Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.

   b) Third set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.

2. **Second Exam – Tuesday November 4th – 1:00-2:15pm – In Class**

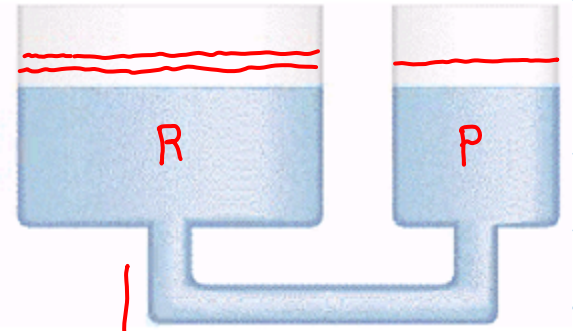
3. 

iClicker:
Choose any letter: A-E

7.7 What Is Le Chatelier's Principle

Adding/Removing Reactants .

Add Reactant



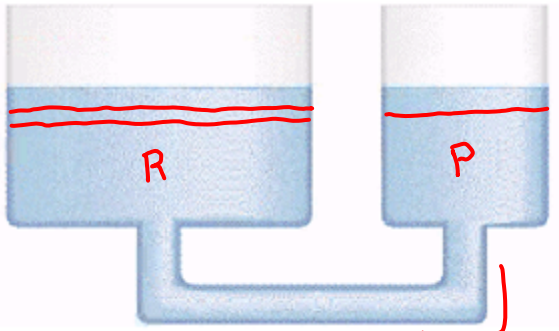
Reaction flows towards P (products)

Add R ... shift towards P ...

more P produced.

Adding R changes the value of [P]/[R] ...
Reaction wants to return to the original value of [P]/[R] ... K

Remove Reactant



Reaction flows towards R (reactants)

Remove R .... shift towards R ....

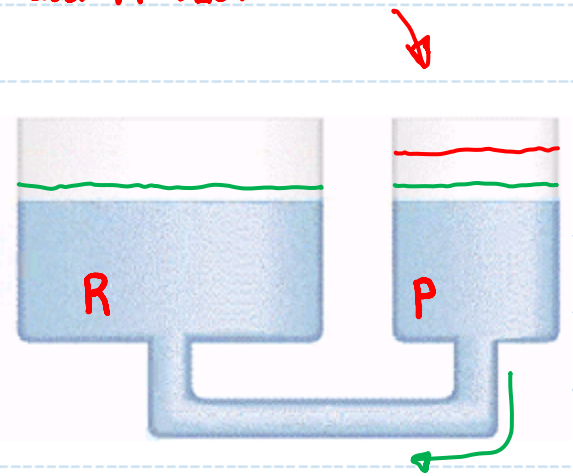
more R produced

Remove R changes the value of [P]/[R] ...
Reaction wants to return to the original value of [P]/[R] ... K

7.7 What Is Le Chatelier's Principle

Adding/Removing Products .

Add Product

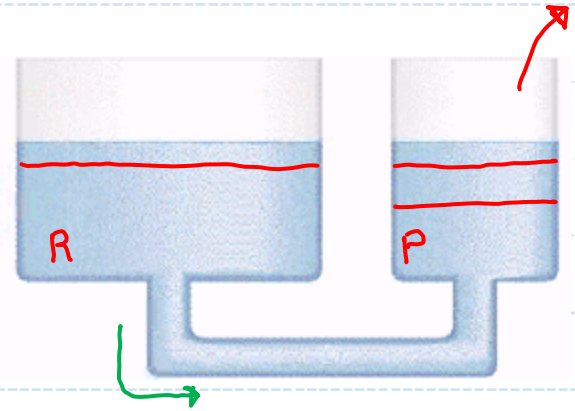


Reaction flows towards R

Add P ... shift towards R ... more R produced.

Adding more P changes the value of [P]/[R] ...
Reaction wants to return to the original [P]/[R]
... K

Remove Product.



Reaction flows towards P

Remove P ... shift towards P ... more P produced.

Removing P changes the value of [P]/[R] ...
Reaction wants to return to the original
[P]/[R] ... K

7.7 What Is Le Chatelier's Principle
Adding/Removing Reactant and Products

HCN is a weak acid –

$HCN(aq) + H_2O(l) \Leftrightarrow H_3O^+ + CN^-$

Removal of H_3O^+ from this equilibrium will cause the $[CN^-]$ to

a) Increase
b) Decrease
c) Remain unchanged
d) Impossible to determine

$HCN(aq) + H_2O(l) \Leftrightarrow H_3O^+ + CN^-$

↳ Remove H_3O^+ ... removing P

⟶ shift towards P ... $[CN^-]\uparrow$

7.7 What Is Le Chatelier's Principle
Adding/Removing Reactant and Products

HCN is a weak acid –

$HCN(aq) + H_2O(l) \Leftrightarrow H_3O^+ + CN^-$

Addition of OH^- to this equilibrium will cause the $[CN^-]$ to

a) Increase
b) Decrease
c) Remain unchanged
d) Impossible to determine

At first glance you might think c), since OH^- is neither a P or an R ... but!

$HCN(aq) + H_2O(l) \Leftrightarrow H_3O^+ + CN^-$

$OH^- = 2\,H_2O(l)$

Adding OH^- removes H_3O^+ (a P)

→ shift towards P ... $[CN^-]\uparrow$

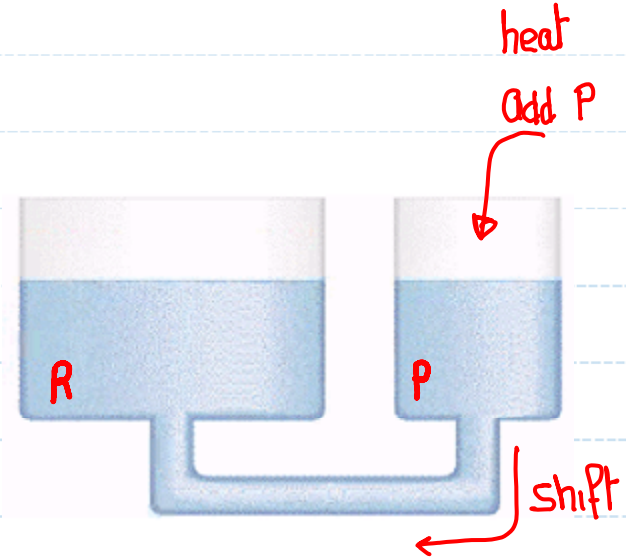
7.7 What Is Le Chatelier's Principle

Changing the Temperature – Exothermic

↳ Reaction that gives off heat

'Heat is a product'

$R \Leftrightarrow P + heat$



If we heat this reaction ... the equivalent of adding a product ... the equilibrium will shift towards Reactants.

Why does this happen ? $K = \frac{[P]}{[R]}$ ... heat is not part of the expression.

But when ↑ heat reaction, $[R]\uparrow$, $[P]\downarrow$ and thus $[P]/[R]\downarrow$ ... ie $K\downarrow$

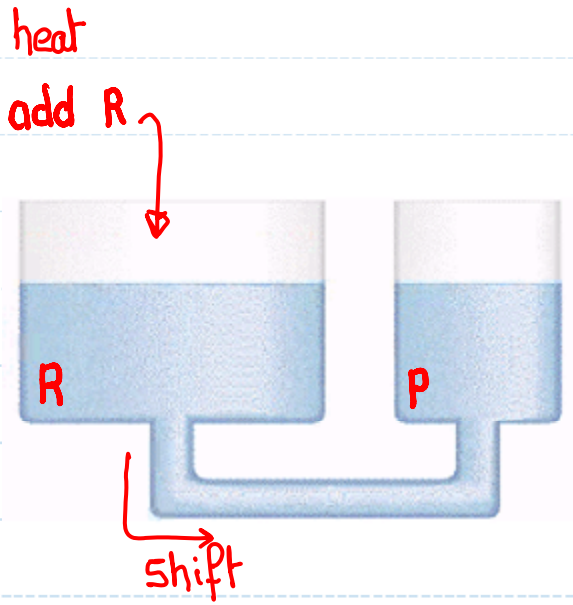
K is dependant on T ... exothermic reaction, as $T\uparrow$: $[R]\uparrow$, $[P]\downarrow$ and $K\downarrow$

7.7 What Is Le Chatelier's Principle

Changing the Temperature – Endothermic

↳ Reaction that requires heat

'Heat is a reactant'



$R + heat \Leftrightarrow P$

If we heat this reaction ... the equivalent of adding more reactant ... the equilibrium will shift towards products.

Why does this happen ... $K = [P]/[R]$ ... heat is not part of the expression!

But when I heat the reaction $[P]\uparrow$, $[R]\downarrow$ and thus $[P]/[R]\uparrow$, ie $K\uparrow$.

K is dependant on T ... endothermic reaction, as $T\uparrow$: $[P]\uparrow$, $[R]\downarrow$ and $K\uparrow$

7.7 What Is Le Chatelier's Principle

Changing the Temperature – Summary

a) Exothermic $R \Leftrightarrow P + heat$

Action	Equilibrium Shift	Why
Add heat (heat the RXN)	Towards Reactants	K↓
Remove heat (cool the RXN)	Towards products	K↑

b) Endothermic $R + heat \Leftrightarrow P$

Action	Equilibrium Shift	Why
Add heat (heat the RXN)	Towards products	K↑
Remove heat (cool the RXN)	Towards Reactants	K↓