Announcements – Lecture XV – Tuesday, Nov 3rd

1. **Fifth Lab – Saturday, November 14th … 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) Final set of Lab Owls will appear in Owl after this lab. There are worth 25% of the Lab Grade.

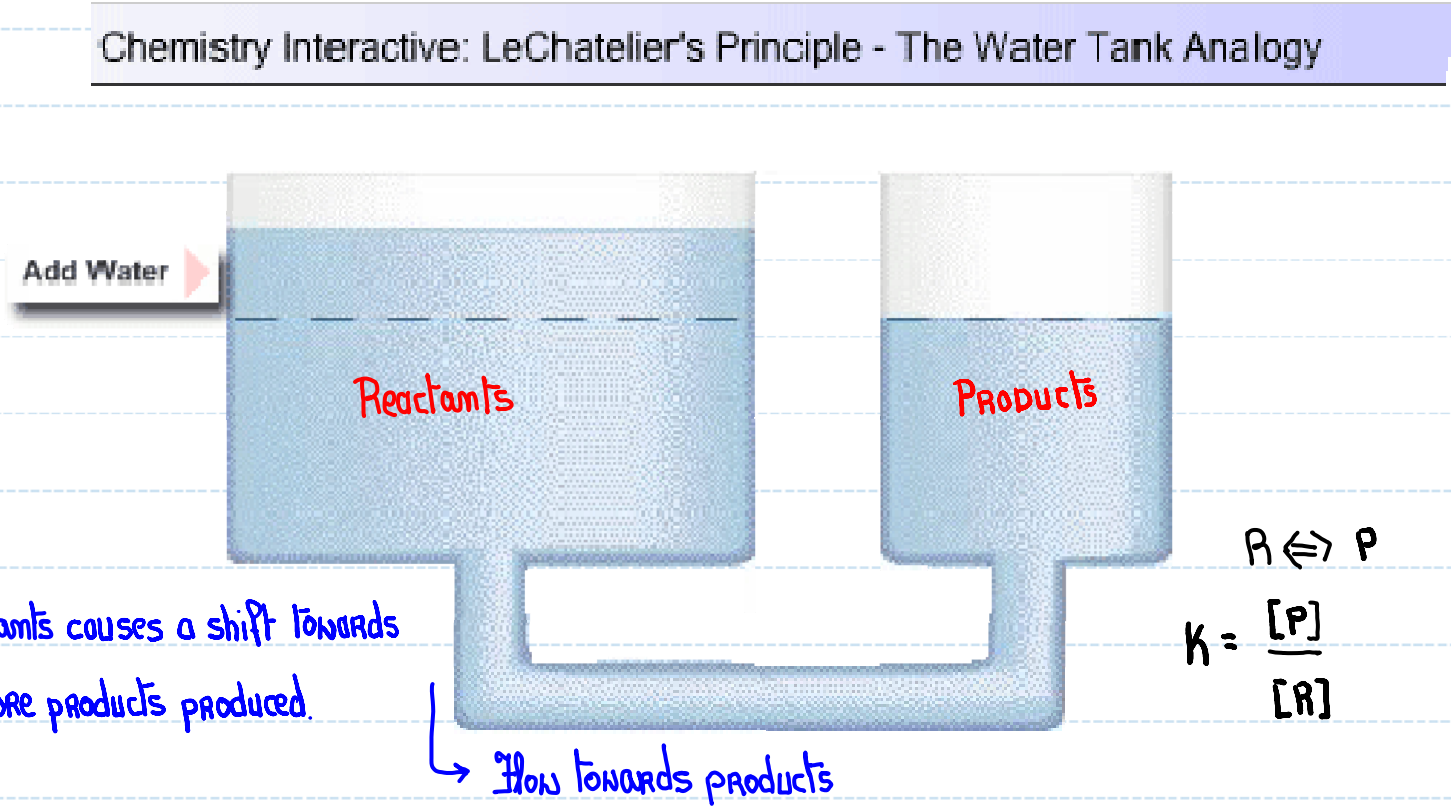
2. **Exam II – Tuesday, November 10th, 1:00-2:15pm, In Class**

3. 

iClicker:
Choose any letter: A-E

7.7 What Is Le Chatelier's Principle

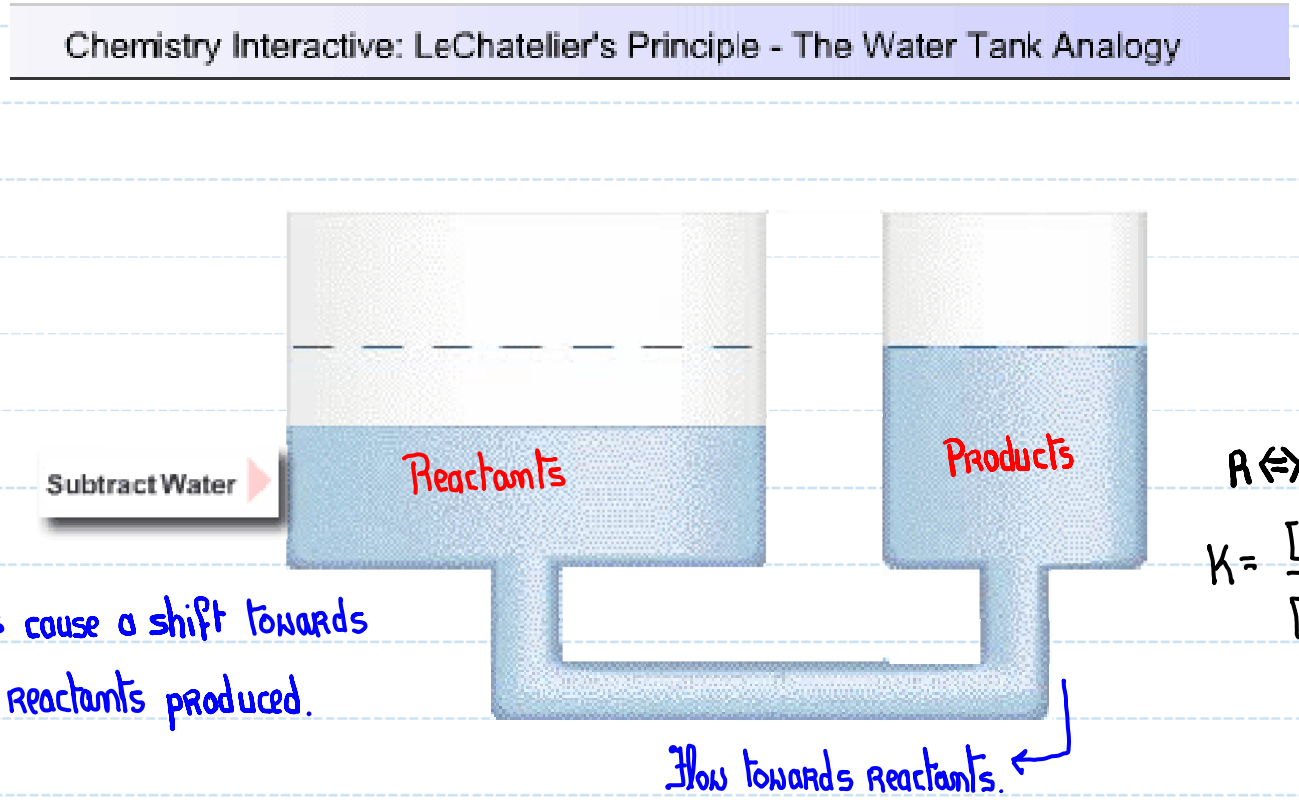
Adding Reactants.



Adding R changes the value of $\frac{[P]}{[R]}$ ... Reaction wants to return to the original value of $\frac{[P]}{[R]}$ ... ie back to K.

7.7 What Is Le Chatelier's Principle

Removing Reactants.

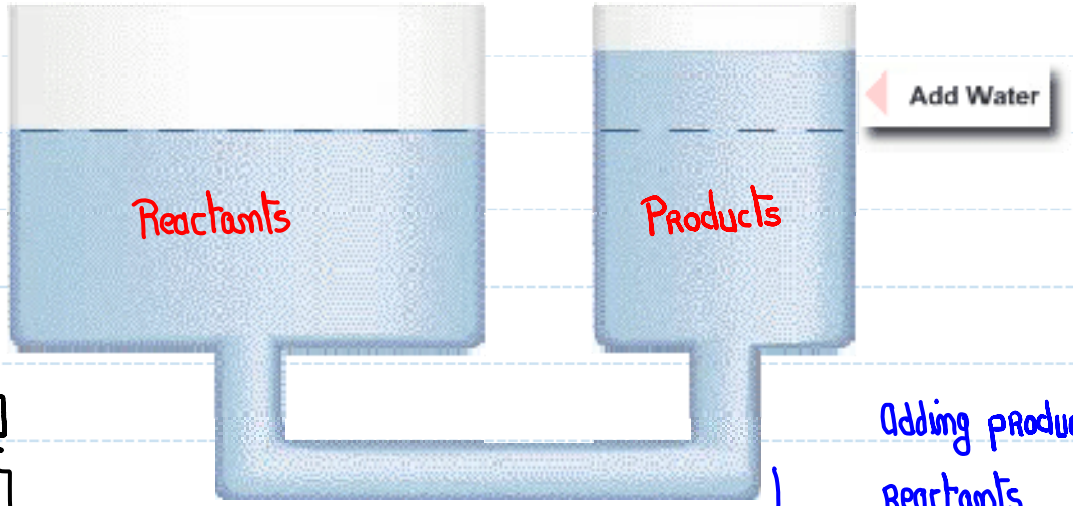


Removing R changes the value of $\frac{[P]}{[R]}$ ... Reaction wants to return to the original value of $\frac{[P]}{[R]}$ ... ie back to K.

7.7 What Is Le Chatelier's Principle

Adding Products .

Chemistry Interactive: LeChatelier's Principle - The Water Tank Analogy



$R \rightleftharpoons P$

$K = \frac{[P]}{[R]}$

Adding products causes a shift towards Reactants ... more Reactants produced.

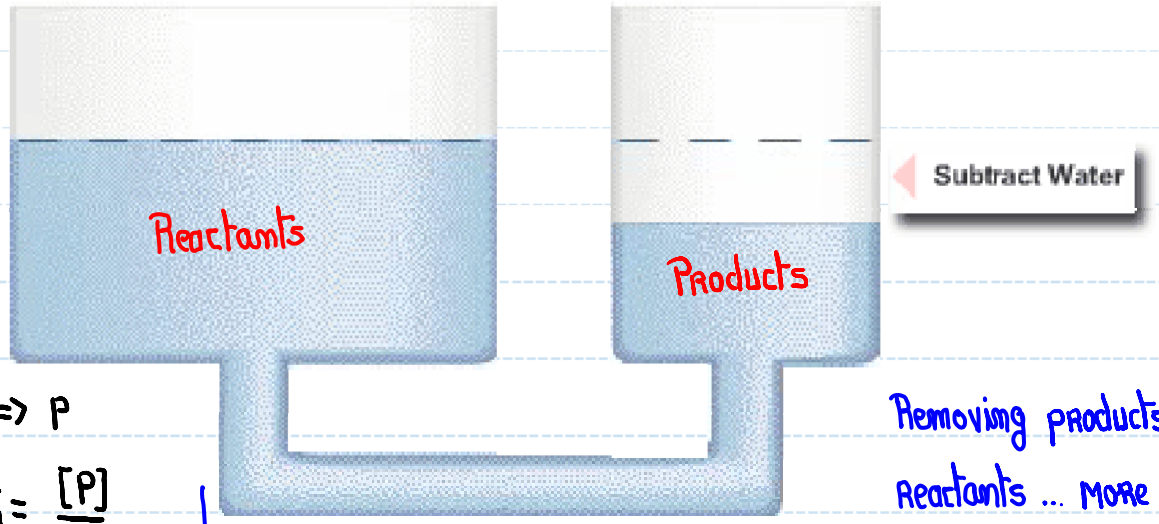
Flow towards Reactants.

Adding P changes the value of $\frac{[P]}{[R]}$ ... Reaction wants to return to the original value of $\frac{[P]}{[R]}$ ... ie back to K.

7.7 What Is Le Chatelier's Principle

Removing Products .

Chemistry Interactive: LeChatelier's Principle - The Water Tank Analogy



$R \Leftrightarrows P$

$K = \frac{[P]}{[R]}$

↳ Flow towards products.

Removing products causes a shift towards Reactants ... more Reactants produced.

Removing P changes the value of $\frac{[P]}{[R]}$ ... Reaction wants to return to the original value of $\frac{[P]}{[R]}$ ... ie back to 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 product or a reactant ... but!

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

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

Adding OH^- removes H_3O^+, a product.

shift towards products ... $[CN^-]\uparrow$

7.7 What Is Le Chatelier's Principle

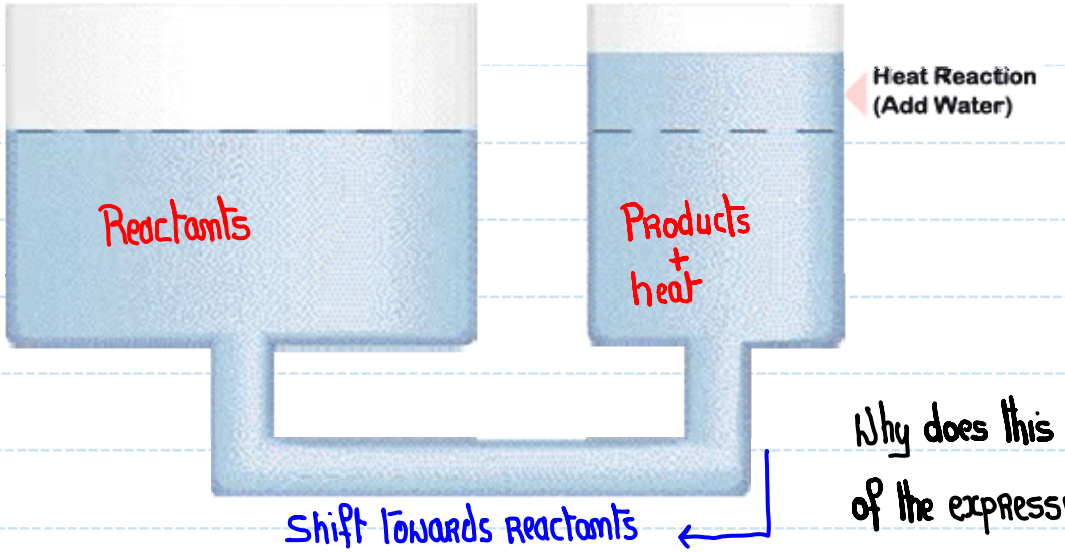
Changing the Temperature – Exothermic

↳ Reaction that gives off heat.

'Heat is a product'

Chemistry Interactive: LeChatelier's Principle - The Water Tank Analogy

$R \Leftrightarrow P + heat$



If we heat this reaction ... the equivalent of adding a product ... reaction shifts towards reactants.

Why does this happen? $K = \frac{[P]}{[R]}$. Heat is not part of the expression! The water tank does correctly predict what happens. $[R]\uparrow, [P]\downarrow$ thus K must ↓

K is dependant on T, in an endothermic reaction

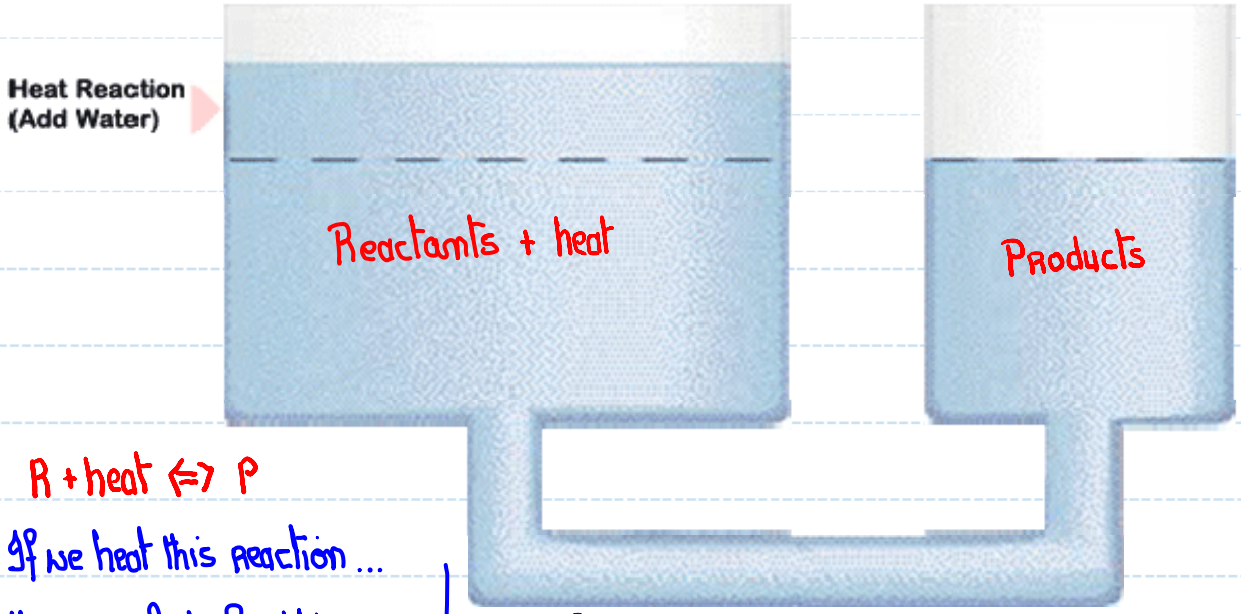
as T↑, K↓ — conversely T↓, K↑

7.7 What Is Le Chatelier's Principle

Changing the Temperature – Endothermic

↳ Reaction that requires heat.
'Heat is a Reactant'

Chemistry Interactive: LeChatelier's Principle - The Water Tank Analogy



Why does this happen?
$K = \frac{[P]}{[R]}$. Heat is not part of the expression! The water tank does correctly predict what happens.
[P]↑, [R]↓, thus K must↑.

R + heat ⇌ P

If we heat this reaction ...
the equivalent of adding a reactant ... reaction shifts towards products.

↳ Shift towards products.

K is dependant on T, in an exothermic reaction as T↑, K↑ _ conversely if T↓, K↓