

Announcements – Lecture XVII – Thursday, Nov 10th

1.



iClicker:

Choose any letter: A-E



7.7 What Is Le Chatelier's Principle Changing the Temperature

Equilibria and Volume

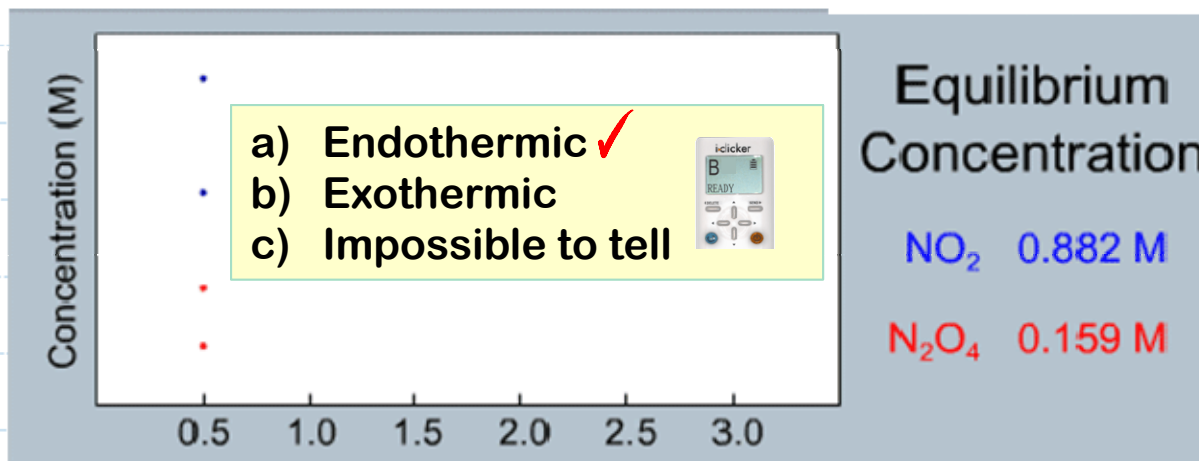
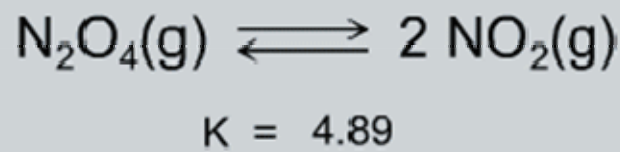
Interactive figure on class web site.

Volume Temperature

0.500 L 82 °C

Calculate

Clear



What is happening to K as you increase the temperature?

K is increasing ... shift towards products ... must be endothermic.

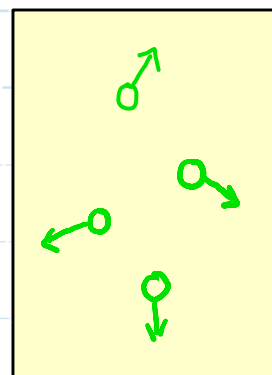
7.7 What Is Le Chatelier's Principle

Changing the Pressure – Gas Phase Equilibria

PRESSURE: force per unit area.

$$R \rightleftharpoons P$$

$$K = \frac{[P]}{[R]} \quad [] = \frac{\# \text{mol}}{V(L)}$$



- 1) Collisions
- 2) Momentum

Gas Reactions: • = Gas molecule



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



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



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

7.7 What Is Le Chatelier's Principle

Changing the Pressure – Gas Phase Equilibria

Equilibria and Volume

Interactive figure on class web site.

Volume Temperature

1.00 L 50 °C

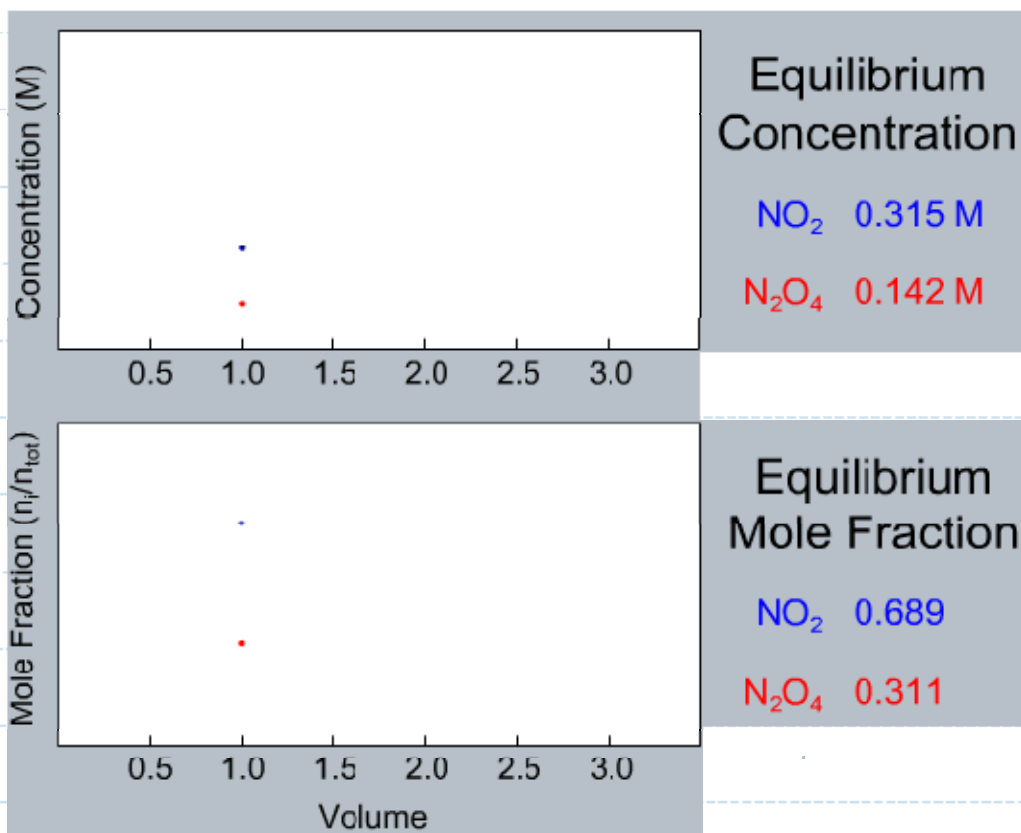
Calculate

Clear

What happens?



$$K = 0.699$$



7.7 What Is Le Chatelier's Principle

Changing the Pressure – Gas Phase Equilibria



ACTION:

Volume ↑ ; Pressure ↓

EQUILIBRIUM SHIFT:

Towards the side with the greater number of gas molecules — trying to restore the pressure ... if it can.

Volume ↓ , Pressure ↑

Towards the side with the fewest number of gas molecules — trying to reduce the pressure ... if it can.



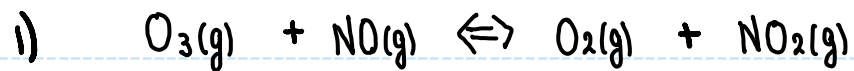
8.8 What Is Le Chatelier's Principle

Changing the Pressure – Summary

ACTION:

EQUILIBRIUM SHIFT:

WHY:



$V \uparrow, P \downarrow$

$V \downarrow, P \uparrow$

No shift.

No shift.



The $\frac{[O_2][NO_2]}{[O_3][NO]}$ ratio is unaffected, the system remains at equilibrium.



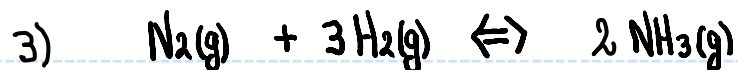
$V \uparrow, P \downarrow$

$V \downarrow, P \uparrow$

Towards products.

Towards reactants.

The $\frac{[NO]^2[Cl_2]}{[NOCl]^2}$ ratio is changed, the system shifts to restore this ratio back to K.



$V \uparrow, P \downarrow$

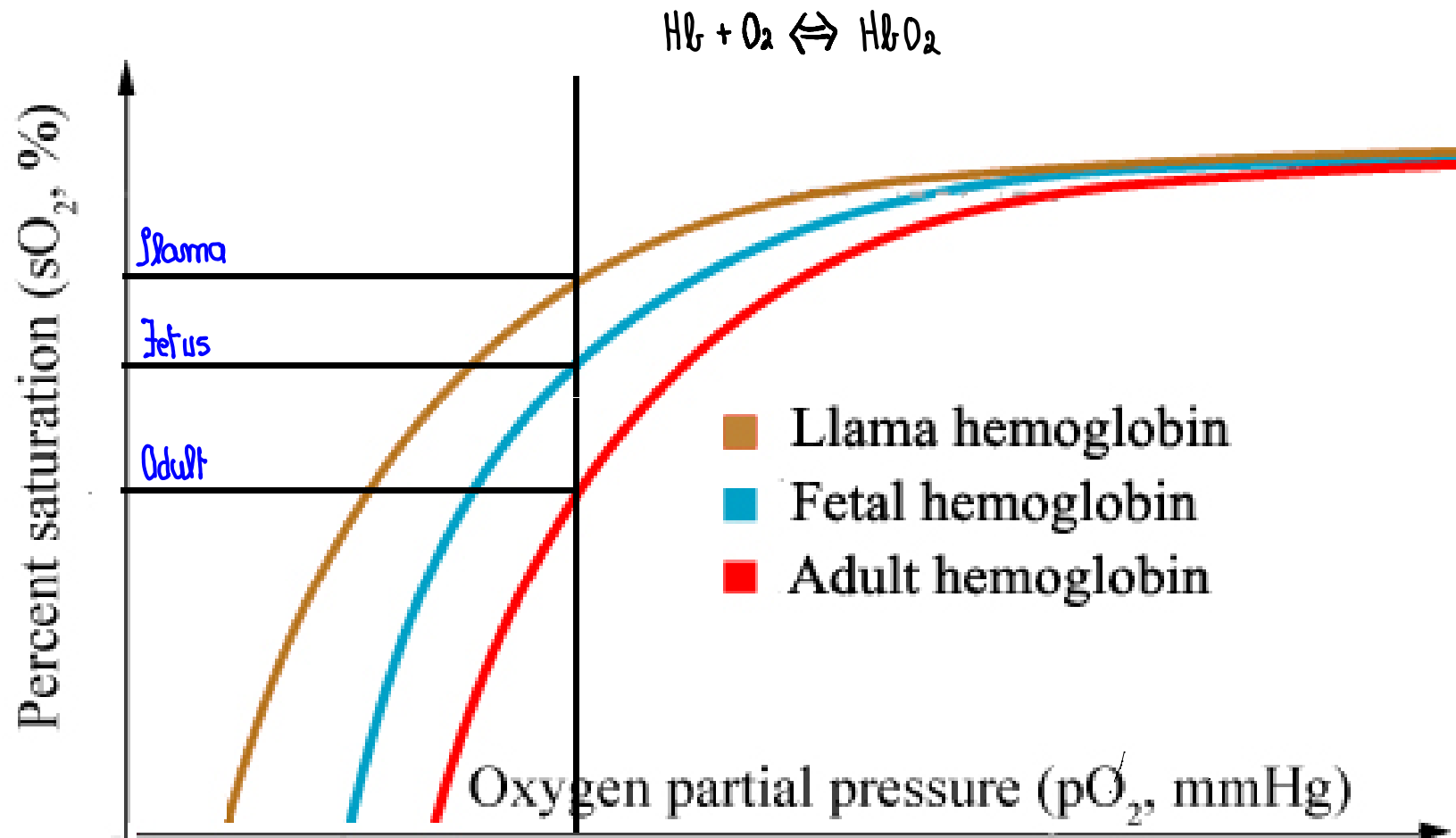
$V \downarrow, P \uparrow$

Towards reactants.

Towards products.

The $\frac{[NH_3]^2}{[N_2][H_2]^3}$ ratio is changed, the system shifts to restore this ratio back to K.

7.7 Le Chatelier's and Hemoglobin



8.1 What Are Acids and Bases?

ACID: A substance that produces H_3O^+ ions in aqueous solution.



BASE: A substance that produces OH^- ions in aqueous solution.

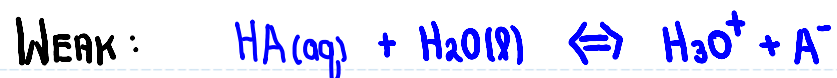


8.2 How Do We Define the Strength of Acids and Bases?

ACIDS:



$\text{HCl}, \text{HBr}, \text{HI}, \text{HNO}_3, \text{H}_2\text{SO}_4, \text{HClO}_4$



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$

BASES:



$$K_b = \frac{[\text{BH}^+][\text{OH}^-]}{[\text{B}]}$$