

# KEY

## LeChatelier Practice

When a stress is applied to a system at equilibrium that system will react in a way to relieve the stress. The stressors on a system are concentration, temperature and pressure. A chemical reaction will respond to one of these stresses by either increasing the rate of the forward or reverse reactions. In other words the reaction will try to fix whatever it is we do to it. If something is removed then the reaction will shift in the direction to replace it. If something is added the reaction will shift in the direction to remove it. The value of the equilibrium constant ( $K_{eq}$ ) will only change if the temperature of the system is changed.

1) Use the following equation to answer the questions. (Increase, decrease, remain the same)



a) How would the concentration of B change if the temperature were increased? ↓

b) How would the concentration of D be effected by removing some B? ↓

c) How would the concentration of A be effected by an increase in pressure? ↑

d) How would the concentration of C be effected by an increase in the concentration of B?  
no C but more C.

2) Use the following equation to answer the questions.



a) What effect would an increase in [Y] have on:

[X] ↓

[Z] ↑

Temp. ↑

b) What effect would an increase in temperature have on:

[Y] ↑

[Z] ↓

c) What effect would a decrease in pressure have on:

[X] ⊗

[Z] ⊗

d) List everything you could do to make this reaction shift in the reverse direction. An example would be to lower the concentration of X.

↓ [X]

↓ [Y]

↑ [Z]

↑ heat

Answer

Questions

- a.  $\leftarrow$   
 b.  $\leftarrow$   
 c.  $\rightarrow$   
 d.  $\rightarrow$   
 e.  $\rightarrow$   
 f. NC
1. For each of the following reactions, describe what effect an increase in pressure would have on the equilibrium position of the reaction (i.e. shift right, shift left, no change).
- a. ~~g.~~  $2\text{H}_2\text{S} \rightleftharpoons 2\text{H}_2(\text{g}) + \text{S}_2(\text{g})$   
 b. ~~h.~~  $2\text{N}_2\text{O}_5(\text{g}) \rightleftharpoons 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$   
 c. ~~i.~~  $4\text{NO}(\text{g}) + 2\text{O}_2(\text{g}) \rightleftharpoons 2\text{N}_2\text{O}_4(\text{g})$   
 d. ~~j.~~  $2\text{NO}(\text{g}) + \text{Br}_2(\text{g}) \rightleftharpoons 2\text{NOBr}(\text{g})$   
 e. ~~k.~~  $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{g})$   
 f. ~~l.~~  $\text{SO}_2(\text{g}) + \text{NO}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g}) + \text{NO}(\text{g})$

- $\rightarrow$   
 $\rightarrow$   
 $\leftarrow$   
 $\leftarrow$   
 $\rightarrow$   
 $\rightarrow$   
 $\rightarrow$   
 $\leftarrow$
2. In which direction would the equilibrium shift for the equation in 1a if  $\text{S}_2$  were removed from the reaction vessel?
3. In which direction would the equilibrium shift for the equation in 1b if  $\text{N}_2\text{O}_5$  were added?
4. In which direction would the equilibrium shift for the equation in 1c if  $\text{O}_2$  were removed?
5. In which direction would the equilibrium shift for the equation in 1d if pressure were decreased?
6. In which direction would the equilibrium shift for the equation in 1e if  $\text{CH}_3\text{OH}$  were removed?
7. In which direction would the equilibrium shift for the equation in 1f if heat were added? (the rxn is endothermic).
8. What would be the effect on the equilibrium position of an equilibrium mixture of  $\text{Br}_2$ ,  $\text{F}_2$ , and  $\text{BrF}_5$  if the total pressure of the system were decreased?



9. What would be the effect on the equilibrium position of an equilibrium mixture of carbon, oxygen, and carbon monoxide if the total pressure of the system were decreased?



10. A weather indicator can be made with a hydrate of cobalt (II) chloride, which changes color as a result of the following reaction:



pink

blue

Does a pink color indicate "moist" or "dry" air? Explain.

Dry