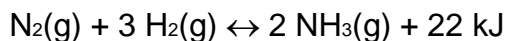


## Le Chatelier's Principle Worksheet #2

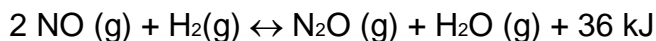


- 1) In the following reaction, will the  $[H_2]$  increase or decrease when equilibrium is reestablished after these stresses are applied?



$NH_3(g)$  is added \_\_\_\_\_       $N_2(g)$  is removed \_\_\_\_\_  
pressure is increased \_\_\_\_\_      Temperature is increased \_\_\_\_\_

- 2) In which direction, left or right, will the equilibrium shift if the following changes are made?



NO is added \_\_\_\_\_      The system is cooled \_\_\_\_\_  
 $H_2$  is removed \_\_\_\_\_      Pressure is increased \_\_\_\_\_  
 $N_2O$  is added \_\_\_\_\_       $H_2$  is removed \_\_\_\_\_

- 3) In this reaction:  $CO_2(g) + H_2(g) + \text{heat} \leftrightarrow CO (g) + H_2O (g)$

Is heat absorbed or released by the forward reaction? \_\_\_\_\_

In which direction will the equilibrium shift if these changes are made?

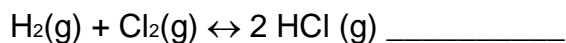
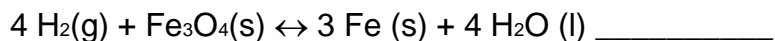
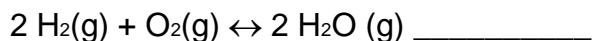
CO is added \_\_\_\_\_      Temperature is increased \_\_\_\_\_  
 $CO_2$  is added \_\_\_\_\_      System is cooled \_\_\_\_\_  
 $H_2$  is removed \_\_\_\_\_      Pressure is increased \_\_\_\_\_  
Catalyst is added \_\_\_\_\_

- 4) In this reaction:  $2 NO (g) + H_2(g) \leftrightarrow N_2O (g) + H_2O (g) + \text{heat}$

What will happen to the  $[H_2O]$  when equilibrium is reestablished after these stresses are applied?

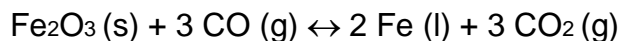
Temperature is increased \_\_\_\_\_  
A catalyst is added \_\_\_\_\_  
Pressure is decreased \_\_\_\_\_  
NO is added \_\_\_\_\_  
 $N_2O$  is removed \_\_\_\_\_

5) How would an increase in pressure affect the  $[H_2]$  in the following reactions?



6) State Le Chatelier's Principle in your own words.

7) The reaction of iron(III) oxide with carbon monoxide occurs in a blast furnace when iron ore is reduced to iron metal:



Use Le Chatelier's Principle to predict the direction of reaction when an equilibrium mixture is disturbed by :

Adding CO (g) \_\_\_\_\_ Removing CO<sub>2</sub> (g) \_\_\_\_\_

Adding Fe<sub>2</sub>O<sub>3</sub> (s) \_\_\_\_\_

8) For the reaction,  $PCl_5 (g) \leftrightarrow PCl_3 (g) + Cl_2 (g)$   $\Delta H_{rxn} = +111 \text{ kJ}$ .

Fill in the following table.

Change	Shifts Reaction Which Way?
add PCl <sub>5</sub>	
remove Cl <sub>2</sub>	
add Ar	
decrease V (or increase P)	
increase T	
add catalyst	

9) For the reaction:  $2HI(g) \leftrightarrow H_2(g) + I_2(g)$   $\Delta H_{rxn} = -51.8 \text{ kJ}$

Fill in the following table:

Change	Shifts Reaction Which Way?
add H <sub>2</sub>	
remove HI	
add Ne	
increase V (decrease P)	
decrease T	