## 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?

$$N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g) + 22\ kJ$$

$NH_3(g)$ 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?

$$2\ NO\ (g) + H_2(g) \leftrightarrow N_2O\ (g) + H_2O\ (g) + 36\ kJ$$

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: $CO_2(g) + H_2(g) + heat \leftrightarrow CO\ (g) + H_2O\ (g)$

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: $2\ NO\ (g) + H_2(g) \leftrightarrow N_2O\ (g) + H_2O\ (g) + heat$

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?

$2\ H_2(g) + O_2(g) \leftrightarrow 2\ H_2O\ (g)$ _____

$4\ H_2(g) + Fe_3O_4(s) \leftrightarrow 3\ Fe\ (s) + 4\ H_2O\ (l)$ _____

$H_2(g) + Cl_2(g) \leftrightarrow 2\ HCl\ (g)$ _____

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 it reduced to iron metal:

$Fe_2O_3\ (s) + 3\ CO\ (g) \leftrightarrow 2\ Fe\ (l) + 3\ CO_2\ (g)$

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

Adding CO (g) _____ Removing $CO_2$ (g) _____

Adding $Fe_2O_3$ (s) _____

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

Fill in the following table.

| Change | Shifts Reaction Which Way? |
|---|---|
| add $PCl_5$ | |
| remove $Cl_2$ | |
| add Ar | |
| decrease V (or increase P) | |
| increase T | |
| add catalyst | |

9) For the reaction: $2HI(g) \leftrightarrow H2(g) + I2(g)$ $\Delta Hrxn = -51.8kJ$

Fill in the following table:

| Change | Shifts Reaction Which Way? |
|---|---|
| add $H_2$ | |
| remove HI | |
| add Ne | |
| increase V (decrease P) | |
| decrease T | |