A reaction in which the ____________ can react to form the ______________
is called a ________________ reaction.

\[ A + B \rightarrow C + D \]

Chemical _________________ occurs when the ____________ in a
____________ reaction form ____________ at the same ____________that
______________ form ________________.

At equilibrium:
- the _________________ of the reactants and products does not
  ________________.
- the concentration of reactants can be _________ to, _______, or
  _________ the concentration of the products.

\[ A + B \rightleftharpoons C + D \]

\[ K_{eq} = \frac{[C][D]}{[A][B]} \]

If \( K_{eq} \) is

<table>
<thead>
<tr>
<th>( \frac{[C][D]}{[A][B]} )</th>
<th>reaction is favored</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 1</td>
<td>neither</td>
</tr>
<tr>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>&gt; 1</td>
<td></td>
</tr>
</tbody>
</table>

Ex. #1: Calculate \( K_{eq} \) for the following reaction using the given equilibrium
concentrations. Then determine whether the forward or reverse reaction
is favored.

\[ \text{N}_2\text{O}_4 \rightleftharpoons 2 \text{NO}_2 \]

\[ \text{[N}_2\text{O}_4\text{]} = 0.23\text{M} \quad \text{[NO}_2\text{]} = 0.037\text{M} \]
Ex. #2: Calculate $K_{eq}$ for the following reaction using the given equilibrium concentrations.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

$[N_2] = \underline{______}$  $[H_2] = \underline{______}$  $[NH_3] = \underline{______}$

The _________ reaction is favored.

LeChatelier’s Principle:

When a _________ is applied to a system in equilibrium, the system reacts in a way to __________________ the stress.

<table>
<thead>
<tr>
<th>STRESS</th>
<th>SYSTEM WILL SHIFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>addition of a chemical</td>
<td></td>
</tr>
<tr>
<td>removal of a chemical</td>
<td></td>
</tr>
<tr>
<td>increase in temperature</td>
<td></td>
</tr>
<tr>
<td>decrease in temperature</td>
<td></td>
</tr>
<tr>
<td>* increase in pressure</td>
<td></td>
</tr>
<tr>
<td>* decrease in pressure</td>
<td></td>
</tr>
<tr>
<td>addition of a catalyst</td>
<td></td>
</tr>
</tbody>
</table>

* applies to reactions involving gases only

examples:

$$N_2 (g) + 3 H_2 (g) \rightleftharpoons 2 NH_3 (g) + \text{heat}$$

- When $H_2$ is added to the system, the reaction shifts to the ___________ to use up the extra $H_2$. The amount of ___________ produced will increase.
- What if _______ is removed, the reaction shifts to the ___________ trying to replenish the $N_2$.
- When the temperature increases, the reaction shifts to the ___________.
- When the pressure of the system increases, the reaction shifts to the ___________, toward the side with ________________ particles.
- When a catalyst is added ________________________________.

When an equilibrium system shifts to the:  | [products] | [reactants] |
------------------------------------------|------------|------------|
right                                     |            |            |
left                                      |            |            |

The Chemistry Quiz

CR1.  CR2.

1.  2.  3.  4.  5.

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