Problems of Equilibria: Le Châtelier's principle

1) Given the reaction:

$C_{(s)} + CO_{2(g)} \rightleftharpoons 2CO_{(g)} \quad \Delta H = 172.5$ kJ

When the temperature of the equilibrium is increased, what will be the effect on the equilibrium position?

2) Consider the reaction:

$2SO_{3(g)} \rightleftharpoons 2SO_{2(g)} + O_{2(g)}$

Predict the effect of decreasing the pressure on the position of the equilibrium.

3) Consider the following reaction:

$I_{2(g)} + Cl_{2(g)} \rightleftharpoons 2ICl_{(g)}$

What would happen to the position of the equilibrium when $I_{2(g)}$ is added to the equilibrium system?

4) Consider the reaction:

$SO_{2(g)} + Cl_{2(g)} \rightleftharpoons SO_2Cl_{2(g)} \quad \Delta H = 62$ kJ

What would happen to the position of the equilibrium when the following changes are made to the equilibrium system?

a) Increase the temperature of the system.

b) Increase the pressure on the system.

c) $Cl_{2(g)}$ is removed from the system.

5) Consider the following reaction:

$4HCl_{(g)} + O_{2(g)} \rightleftharpoons 2Cl_{2(g)} + 2H_2O_{(g)} \quad \Delta H = -114$ kJ

Find out the changes in temperature and pressure that cause the equilibrium to shift to the right.

6) Given the reaction:

$2NO_{2(g)} \rightleftharpoons N_2O_{4(g)} \quad \Delta H = -58$ kJ

When the temperature of the equilibrium is increased, what will be the effect on the equilibrium position?

7) Given the reaction:

$2NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$

Predict the effect of increasing the pressure on the position of the equilibrium.

8) Consider the following reaction:

$2NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$

What would happen to the position of the equilibrium when $NH_{3(g)}$ is added to the equilibrium system?

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Answers:

1) Shifts right (toward products).
An increase in temperature favors the endothermic reaction.

2) Shifts right (toward products).
A decrease in pressure increase the number of moles of gas.

3) Shifts right (toward products).
To counteract the increased concentration of $I_{2(g)}$.

4) **a)** Shifts right (toward products).
An increase in temperature favors the endothermic reaction.
b) Shifts right (toward products).
An increase in pressure decrease the number of moles of gas.
c) Shifts left (toward reactants).
To counteract the decreased concentration of $Cl_{2(g)}$.

5) Decrease the temperature to favor the exothermic reaction.
Increase the pressure to decrease the number of moles of gas.

6) Shifts left (toward reactants).
An increase in temperature favors the endothermic reaction.

7) Shifts left (toward reactants).
An increase in pressure decrease the number of moles of gas.

8) Shifts right (toward products).
To counteract the increased concentration of $NH_{3(g)}$.