

Chemistry 12: Unit II Quiz 3

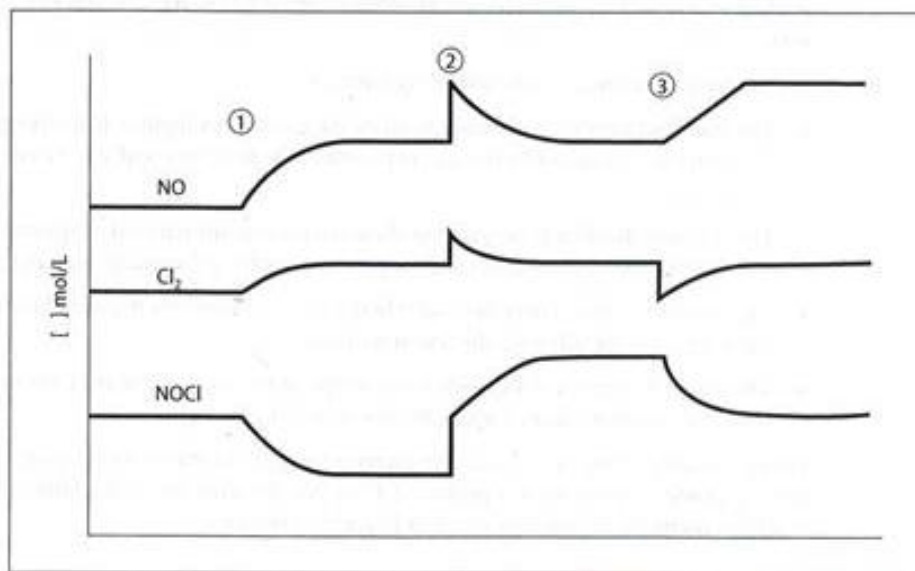
Learning Goals B3: Le Chatelier's Principle

Name:

Block:

1. The following graph shows three different stresses on the reaction:
 $2 \text{NOCl}_{(g)} + \text{heat} \rightleftharpoons 2 \text{NO}_{(g)} + \text{Cl}_{2(g)}$

For each stress, numbered 1, 2, and 3 on the graph, decide what has occurred and explain why the graph changed the way it did.

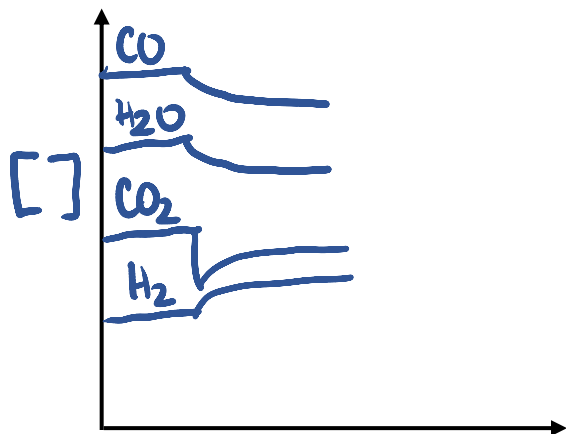


- Stress 1: **An increase in temperature has occurred. The system will shift right to reestablish equilibrium. A shift right, to the products means the concentration of products will increase while the reactants decrease. Favors endothermic reaction, initially the forward rate will increase more than the reverse reaction resulting in a shift to the right.**
- Stress 2: **Increase in pressure (or decrease in volume) shifts the equilibrium to the left (fewer moles of gas on reactant side, relieving the increase in pressure). A decrease in volume causes the concentration of all chemical species to increase.**
- Stress 3: **Remove (decrease concentration) Cl₂ – Fewer collisions between Cl₂ and NO, the reverse reaction slows down but the forward reaction continues at the same rate initially (forward rate > reverse rate) EQM shifts to the right, product concentrations increase and reactant concentration decreases.**

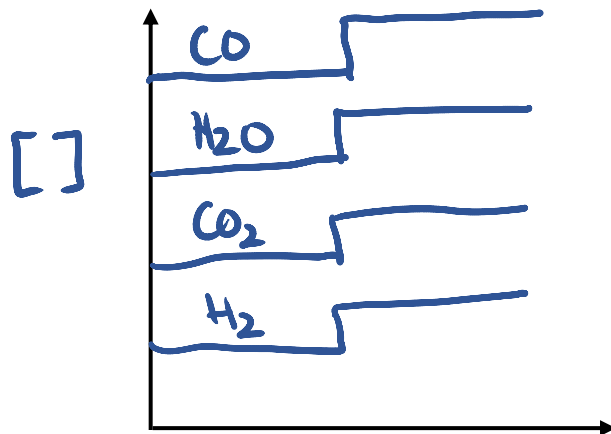
2. Show graphically what will happen to the following equilibrium when:



a) some CO_2 (g) is removed.

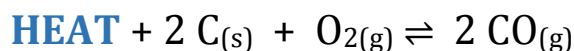


b) total pressure is increased.



2. The following reaction forms an equilibrium. When the equilibrium system is heated, the concentration of carbon monoxide increases.

Determine whether the forward reaction is exothermic or endothermic and **add the word "heat" on the appropriate side of the equation**. Include an explanation of how you came to this conclusion.



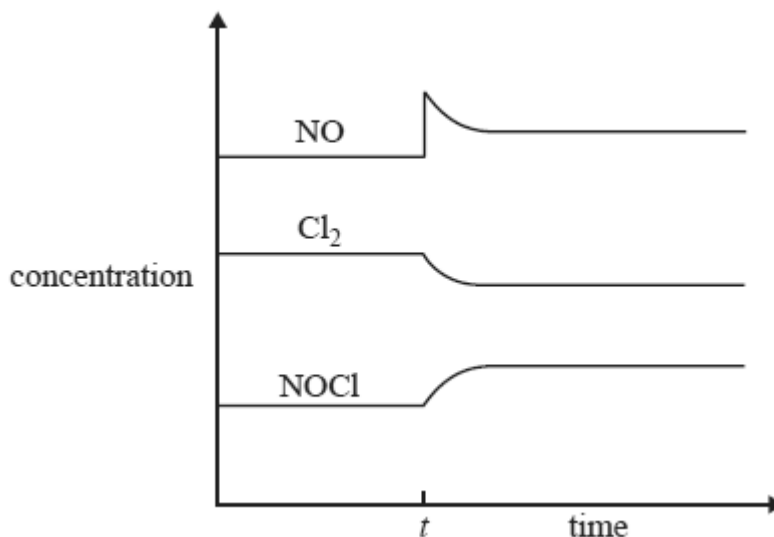
Forward reaction is (ENDOTHERMIC or EXOTHERMIC)? **ENDOTHERMIC**

Explanation:

Using LCP, a shift is always away from an increase. The result of the stress caused the concentration of CO to increase, we know the shift was in the forward direction indicating that the heat term must be on the reactant side and this is an endothermic reaction.

Entropy is increasing in the forward direction and the tendency to go to the side with maximum entropy favors the formation of products therefore the tendency to go to the side with minimum enthalpy must favor the formation of reactants. If the reactants have minimum enthalpy then the forward reaction must be endothermic.

4. a) Determine what the stress was that caused the equilibrium below to react as graphed.

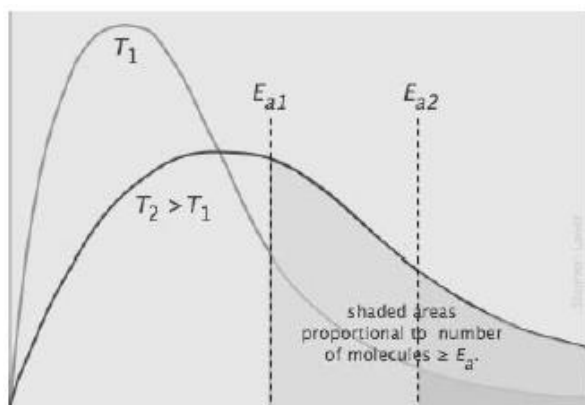


Stress: **Increase concentration of NO (NO was added)**

b) If the temperature of the above reaction was increased, explain why the reverse reaction would speed up? (You may explain either from an activation energy point of view OR stressing the system point of view)

Reverse reaction is ENDOTHERMIC, and an increase in temperature favors endothermic reactions.

An increase in temperature increases the average kinetic energy of the system, resulting in all particles moving faster, colliding more often and colliding with more energy. As a result, a greater proportion of collisions will be successful and the reverse reaction increases. The rate of the forward reaction also increases but the proportion of successful collisions increases more for the reverse reaction (see diagram below - E_{a1} is for the forward reaction, E_{a2} is for the reverse reaction).



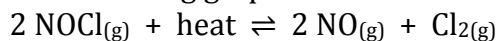
Chemistry 12: Unit II Quiz 3

Learning Goals B3: Le Chatelier's Principle

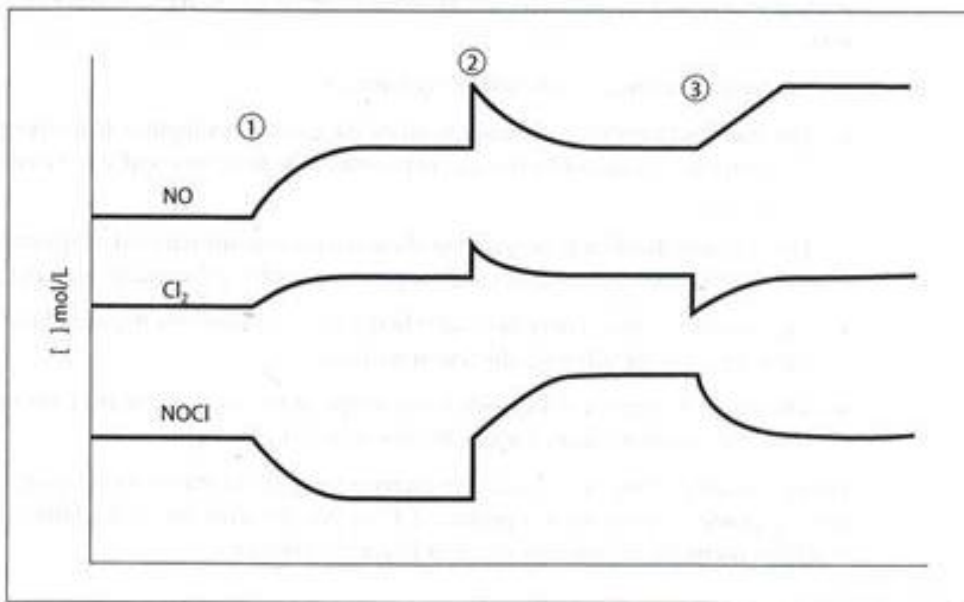
Name:

Block:

3. The following graph shows three different stresses on the reaction:



For each stress, numbered 1, 2, and 3 on the graph, decide what has occurred and explain why the graph changed the way it did.



Stress 1:

Stress 2:

Stress 3:

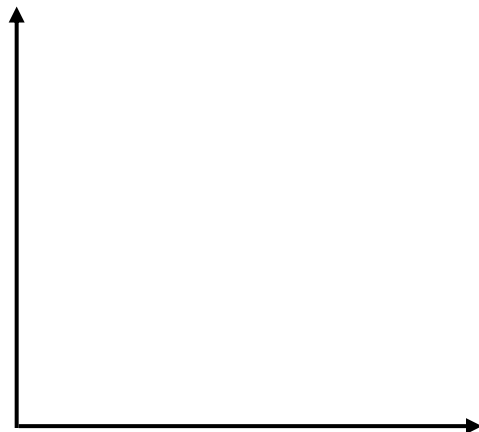
2. Show graphically what will happen to the following equilibrium when:



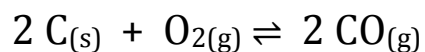
a) some CO_2 (g) is removed.



b) total pressure is increased.



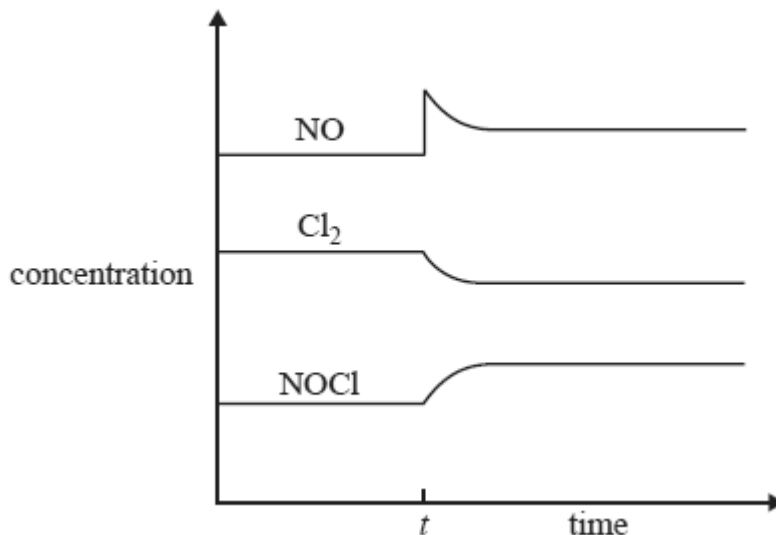
3. The following reaction forms an equilibrium. Determine whether the forward reaction is exothermic or endothermic and **add the word "heat" on the appropriate side of the equation.** Include an explanation of how you came to this conclusion.



Forward reaction is (ENDOTHERMIC or EXOTHERMIC)? _____

Explanation:

5. a) Determine what the stress was that caused the equilibrium below to react as graphed.



Stress: _____

b) If the temperature of the above reaction was increased, explain why the reverse reaction would speed up? (You may explain either from an activation energy point of view OR stressing the system point of view)

Learning Goal	Question	I'm a Star ★	I've got it! ☺	I'm almost there...	I'll keep working on it
B3: Apply Le Chatelier's principle to the shifting of equilibrium.	1-4				