

Name: _____

Period: _____

Seat#: _____

- 1) Explain how the following changes in reaction conditions will affect the position of the equilibrium below AND explain your reasoning. $A_{(g)} + B_{(aq)} \leftrightarrow C_{(s)} \quad \Delta H_{rxn} = -453 \text{ kJ/mol}$

Stressor	Shift L or R?	Explain
The pressure of A in the reaction chamber is increased		
The temperature of the reaction is increased by 20°C		
A catalyst is added to the system		
As the reaction progresses, more B is steadily added to the reaction chamber.		
An inhibitor is added to the reaction chamber.		
Argon gas is added to the reaction chamber, doubling the pressure.		

- 2) The following equilibrium may be established with carbon dioxide and steam. Identify the effects that the changes below will have. $CO_{(g)} + H_2O_{(g)} \leftrightarrow CO_{2(g)} + H_{2(g)} + \text{heat}$

Stressor	Shift L or R?	$\Delta [CO]$	$\Delta [H_2O]$	$\Delta [CO_2]$	$\Delta [H_2]$	$\Delta \text{Temp.}$
Addition of more H ₂ O						
Removal of some H ₂						
Raising Temperature						
Increasing Pressure						
Addition of a Catalyst						

- 3) The following equilibrium may be established with carbon dioxide and steam. Identify the effects that the changes below will have. $CO_{(g)} + 2H_{2(g)} \leftrightarrow CH_3OH_{(g)}$

Stressor	Shift L or R?	$\Delta [CO]$	$\Delta [H_2]$	$\Delta [CH_3OH]$
Removal of CH ₃ OH				
Increase in Pressure				
Lowering H ₂ Concentration				
Addition of a Catalyst				

Dougherty Valley HS Chemistry
Equilibrium – Le Chatelier’s Principle Practice #3

4) A small percentage of nitrogen gas and oxygen gas in the air combine at high temperatures found in automobile engines to produce $\text{NO}_{(g)}$, which is an air pollutant. $\text{N}_{2(g)} + \text{O}_{2(g)} + \text{heat} \leftrightarrow 2\text{NO}_{(g)}$

a. Higher engine temperatures are used to minimize carbon monoxide production. What effect does higher engine temperatures have on the production of $\text{NO}_{(g)}$? Why? Is this good or bad?

b. What effect would high pressures have on the production of $\text{NO}_{(g)}$? Why?

5) What would the effect of each of the following be on the equilibrium involving the reaction of coke, $\text{C}_{(s)}$ with steam to give $\text{CO}_{(g)}$ and $\text{H}_{2(g)}$? $\text{C}_{(s)} + \text{H}_2\text{O}_{(g)} \leftrightarrow \text{CO}_{(g)} + \text{H}_{2(g)}$

Stressor	Shift L or R?	$\Delta [\text{C}]$	$\Delta [\text{H}_2\text{O}]$	$\Delta [\text{CO}]$	$\Delta [\text{H}_2]$
The Addition of Steam					
Increase in Pressure					
Removal of H_2 as it is Produced					
Addition of a Catalyst					

6) The binding of oxygen to hemoglobin (abbreviated Hb), giving oxyhemoglobin (HbO_2) is partially regulated by the concentration of H^+ and CO_2 in the blood. Although the equilibrium is rather complicated it can be summarized as follows: $\text{HbO}_2 + \text{H}^+ + \text{CO}_2 \leftrightarrow \text{CO}_2\text{HbH}^+ + \text{O}_2$ According to Le Chatelier’s Principle, what would the effect be of the following stressors?

Stressor	Shift L or R?	$\Delta [\text{HbO}_2]$	$\Delta [\text{H}^+]$	$\Delta [\text{CO}_2]$	$\Delta [\text{CO}_2\text{HbH}^+]$	$\Delta [\text{O}_2]$
The production of lactic acid (contains H^+) and CO_2 in a muscle during exercise?						
Inhaling fresh oxygen enriched air?						