**Name: Period: Seat#:**

**Worksheet #4**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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) ↔ C (s) ∆Hrxn = -453 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. |  |  | |
| 1. The following equilibrium may be established with carbon dioxide and steam. Identify the effects that the changes below will have. **CO(g) + H2O(g) ↔CO2 (g) + H2 (g) + heat**  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Stressor** | **Shift L or R?** | **∆ [CO]** | **∆ [H2O]** | **∆ [CO2]** | **∆ [H2]** | **∆ Temp.** | | Addition of more H2O |  |  |  |  |  |  | | Removal of some H2 |  |  |  |  |  |  | | Raising Temperature |  |  |  |  |  |  | | Increasing Pressure |  |  |  |  |  |  | | Addition of a Catalyst |  |  |  |  |  |  | |
| 1. The following equilibrium may be established with carbon dioxide and steam. Identify the effects that the changes below will have. **CO(g) + 2H2(g) ↔ CH3OH(g)**  |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Stressor** | **Shift L or R?** | **∆ [CO]** | **∆ [H2]** | **∆ [CH3OH]** | | Removal of CH3OH |  |  |  |  | | Increase in Pressure |  |  |  |  | | Lowering H2 Concentration |  |  |  |  | | Addition of a Catalyst |  |  |  |  | |
| 1. A small percentage of nitrogen gas and oxygen gas in the air combine at high temperatures found in automobile engines to produce NO(g), which is an air pollutant. **N2(g) + O2(g) + heat ↔ 2NO(g)**    1. Higher engine temperatures are used to minimize carbon monoxide production. What effect does higher engine temperatures have on the production of NO(g)? Why? Is this good or bad?    2. What effect would high pressures have on the production of NO(g)? Why? |
| 1. What would the effect of each of the following be on the equilibrium involving the reaction of coke, C(s) with steam to give CO(g) and H2(g)? **C(s) + H2O(g) ↔CO(g) + H2(g)**  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Stressor** | **Shift L or R?** | **∆ [C]** | **∆ [H2O]** | **∆ [CO]** | **∆ [H2]** | | The Addition of Steam |  |  |  |  |  | | Increase in Pressure |  |  |  |  |  | | Removal of H2 as it is Produced |  |  |  |  |  | | Addition of a Catalyst |  |  |  |  |  | |
| 1. The binding of oxygen to hemoglobin (abbreviated Hb), giving oxyhemoglobin (HbO2) is partially regulated by the concentration of H+ and CO2 in the blood. Although the equilibrium is rather complicated it can be summarized as follows: **HbO2 + H+ + CO2 ↔ CO2HbH+ + O2**  According to Le Chatelier’s Principle, what would the effect be of the following stressors?  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Stressor** | **Shift L or R?** | **∆ [HbO2]** | **∆ [H+]** | **∆ [CO2]** | **∆ [CO2HbH+]** | **∆ [O2]** | | The production of lactic acid (contains H+) and CO2 in a muscle during exercise? |  |  |  |  |  |  | | Inhaling fresh oxygen enriched air? |  |  |  |  |  |  | |