ROSEDALE | ROSEDALE GLOBAL HIGH SCHOOL

# SCH4U 4-1F: Chemical Equilibrium

## ANSWER KEY

### Applying Le Chatelier's Principle in Chemical Equilibrium

**Use** Le Chatelier's Principle to **determine** in which direction equilibrium will shift in each scenario. Complete the following charts by writing left, right, or none for the equilibrium shift, and decreases, increases, or remains the same for the concentrations of reactants and products . **Justify** your reasoning.

1. $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)} + 22.0$ kcal (heat)

| Stress | Equilibrium Shift | Reasoning |
|---|---|---|
| Add $N_2$ | → (right) | To consume excess $N_2$ |
| Remove $H_2$ | ← (left) | To accommodate limited $H_2$ by creating more $H_2$ |
| Increase Temperature | ← (left) | Exothermic reaction: will shift to absorb the heat |
| Increase Pressure | → (right) | Shift to the side that has less moles. 4 moles of reactants used to make 2 moles of products |

2. 12.6 kcal (heat) + $H_{2(g)} + I_{2(g)} \leftrightarrow 2HI_{(g)}$

| Stress | Equilibrium Shift | Reasoning |
|---|---|---|
| Remove $H_2$ | ← (left) | To accommodate limited $H_2$ by creating more $H_2$ |
| Adding a Catalyst | No shift | Catalysts do not affect equilibrium |
| Increase Temperature | → (right) | Endothermic, reaction shifts to absorb heat |
| Decrease Pressure | No Shift | Both sides have an equal number of moles |

3. $CaCO_{3(s)}$ + 170 kJ (heat) ↔ $CaO_{(s)}$ + $CO_{2(g)}$

| Stress | Equilibrium Shift | Reasoning |
|---|---|---|
| Decrease Temperature | ← (left) | Endothermic reaction, reaction shifts to create heat |
| Add $CO_2$ | → (right) | Shifts to use up the extra $CO_2$ |
| Remove CO | → (right) | To accommodate limited CO by creating more CO |
| Increase Pressure | ← (left) | Gasses of a ratio of 1:2, so increase pressure, we shift towards the lower pressure to accommodate |