## Le Chatelier's Principle

1. Consider the following equation to answer the questions below.

CO (g) + 2 H<sub>2</sub> (g) 
$$\stackrel{\text{Ca/ZnO/Al}_2O_3}{\rightleftharpoons}$$
 CH<sub>3</sub>OH (g)  $\Delta H = -91 \text{ kJ}$ 

Indicate if the yield of CH₃OH will increase, decrease, or have no effect with the following changes:

- a) concentration of H<sub>2</sub> is increased
- b) concentration of CO is decreased
- c) the pressure is increased by decreasing the volume
- d) the temperature is increased
- e) remove the catalyst
- f) sulfuric acid is added and reacts with CO
- g) decrease the temperature
- h) add some argon gas
- i) remove some methanol
- j) continuously remove methanol as it is formed