1977 D

For the system 2 SO2*(g)* + O2*(g)* ↔ 2 SO3*(g)* , Δ*H* is negative for the production of SO3. Assume that one has an equilibrium mixture of these substances. Predict the effect of each of the following changes on the value of the equilibrium constant and on the number of moles of SO3 present in the mixture at equilibrium. Briefly account for each of your predictions. (Assume that in each case all other factors remain constant.)

(a) Decreasing the volume of the system.

(b) Adding oxygen to the equilibrium mixture.

(c) Raising the temperature of the system.

1980 D

NH4Cl*(s)* ↔ NH3*(g)* + HCl*(g)* Δ*H* = +42.1 kilocalories

Suppose the substances in the reaction above are at equilibrium at 600K in volume V and at pressure P. State whether the partial pressure of NH3*(g)* will have increased, decreased, or remained the same when equilibrium is reestablished after each of the following disturbances of the original system. Some solid NH4Cl remains in the flask at all times. Justify each answer with a one-or-two sentence explanation.

(a) A small quantity of NH4Cl is added.

(b) The temperature of the system is increased.

(c) The volume of the system is increased.

(d) A quantity of gaseous HCl is added.

(e) A quantity of gaseous NH3 is added.

1988 D

NH4HS*(s)* ↔ NH3*(g)* + H2S*(g)* ΔHº = +93 kilojoules

The equilibrium above is established by placing solid NH4HS in an evacuated container at 25ºC. At equilibrium, some solid NH4HS remains in the container. Predict and explain each of the following.

(a) The effect on the equilibrium partial pressure of NH3 gas when additional solid NH4HS is introduced into the container

(b) The effect on the equilibrium partial pressure of NH3 gas when additional solid H2S is introduced into the container

(c) The effect on the mass of solid NH4HS present when the volume of the container is decreased

(d) The effect on the mass of solid NH4HS present when the temperature is increased.

1998 D

C*(s)* + H2O*(g)* ↔ CO*(g)* + H2*(g)* Δ*Hº* = +131kJ

A rigid container holds a mixture of graphite pellets (C*(s)*), H2O*(g)*, CO*(g)*, and H2*(g)* at equilibrium. State whether the number of moles of CO*(g)* in the container will increase, decrease, or remain the same after each of the following disturbances is applied to the original mixture. For each case, assume that all other variables remain constant except for the given disturbance. Explain each answer with a short statement.

(a) Additional H2*(g)* is added to the equilibrium mixture at constant volume.

(b) The temperature of the equilibrium mixture is increased at constant volume.

(c) The volume of the container is decreased at constant temperature.

(d) The graphite pellets are pulverized.