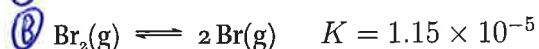
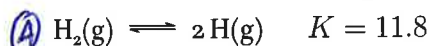


Quiz 15.2 – Working With  $K$  and  $Q$ Name: KeryFor questions 1–3, consider the reaction:  $\text{H(g)} + \text{Br(g)} \rightleftharpoons \text{HBr(g)}$   $\star$ 

## Question 1

Calculate  $K$  from the following reactions:

$$\star = -\frac{1}{2} \textcircled{A} - \frac{1}{2} \textcircled{B} + \frac{1}{2} \textcircled{C}$$

$$\therefore K_{\star} = \frac{\sqrt{K_{\textcircled{C}}}}{\sqrt{K_{\textcircled{A}} K_{\textcircled{B}}}} = 4,530$$

## Question 2

If the system has reached equilibrium with  $[\text{HBr}] = 0.025 \text{ M}$  and  $[\text{H}] = 0.0015 \text{ M}$ , find  $[\text{Br}]$ 

$$4,530 = \frac{[\text{HBr}]}{[\text{H}][\text{Br}]} \quad 4,530 = \frac{0.025 \text{ M}}{0.0015 \text{ M} \cdot [\text{Br}]} \rightarrow [\text{Br}] = 0.0037 \text{ M}$$

## Question 3

Find the reaction quotient  $Q$  and predict which direction the reaction must shift to reach equilibrium if  $[\text{HBr}] = 0.0035 \text{ M}$ ,  $[\text{H}] = 0.020 \text{ M}$ , and  $[\text{Br}] = 0.0025 \text{ M}$ 

$$Q = \frac{[\text{HBr}]}{[\text{H}][\text{Br}]} = \frac{0.0035 \text{ M}}{0.020 \text{ M} \cdot 0.0025 \text{ M}} = 70$$

 $Q < K$ , so the reaction must shift toward products

## Question 4

The reaction  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2 \text{HI(g)}$  is at equilibrium with  $[\text{H}_2] = 0.05 \text{ M}$ ,  $[\text{I}_2] = 0.05 \text{ M}$ , and  $[\text{HI}] = 0.90 \text{ M}$ . Calculate  $K$  from these values

$$K = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{0.90^2}{0.05 \cdot 0.05} = 324$$

## Bonus Question!

Comparing the  $K$  values for the production of HBr and HI from their elemental constituents, what can you say about the relative stability of HBr and HI?

Compare 324 to 2,780 (from equation  $\textcircled{C}$ ) for HBr. HI is less stable than HBr