Answer on Question#37638-Chemistry-Other

Question

The equilibrium constant for the following reaction at 450 K, S (s) + O_2 (g) = SO_2 (g), is found 4.2 x 10^{52}.
(1) Write the equilibrium constant expression.
(2) What is K_P for the reaction?
(3) Since the reaction is much product favoured, why can a pile of yellow sulphur exist in the environment?

Answers

(1)

$$K = \frac{[SO_2]}{[S] \cdot [O_2]}$$

(2)

$$K_p = \frac{P_{SO_2}}{P_{O_2}},$$

where P_i - partial pressure of a substance.

(3) According to law of mass action the reaction rate is expressed by the following kinetic equation

$$r = k[S][O_2]$$

When sulfur concentration in gas phase is negligible, the reaction rate is negligible.
When heating the sulfur to high temperature (e.g. by firing), some amount of it vaporizes and the reaction becomes possible. Due to the reaction exothermicity sulfur concentration in gas phase is kept sufficient for the reaction to proceed.
But in the environment sulfur is solid and its concentration in gas phase is almost equal to zero. That is why a pile of yellow sulphur exists in the environment.