

Equilibrium Expression



$$\text{forward rate} = K [A]^a [B]^b$$

$$\text{reverse rate} = K' [C]^c [D]^d$$

at equilibrium forward rate = reverse rate

$$\therefore K [A]^a [B]^b = K' [C]^c [D]^d$$

$$\therefore \frac{K}{K'} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

$$\therefore \boxed{K_{eq} = \frac{[C]^c [D]^d}{[A]^a [B]^b}}$$

where $K_{eq} = \frac{K}{K'}$ which is a number!

K_{eq} is the equilibrium constant

- experimentally determined
- it is a number
- units are dropped!
- K_{eq} is temperature dependent
- K_{eq} will also depend the way the equilibrium is written

$$\frac{[C]^c [D]^d}{[A]^a [B]^b}$$

- only components (compounds or ions etc) with variable concentration are included

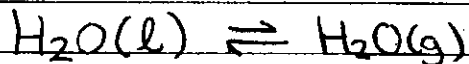
- gas (g), aqueous (aq) are variable ^{and} in the equilibrium expression

- (s) and (l) are not

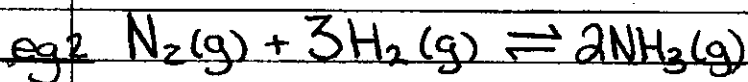
products
reactants

$$K_{eq} = \frac{1}{[H_2O(g)]}$$

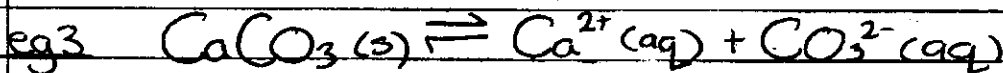
{ K_{eq} value since its effect and concentration are constant }



$$K_{eq} = [H_2O(g)]$$



$$K_{eq} = \frac{[NH_3]^2}{[N_2][H_2]^3}$$



$$K_{eq} = [Ca^{2+}][CO_3^{2-}]$$

11, 12, 13