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# Equilibrium Constant Formulas

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# List of 12 Equilibrium Constant Formulas

## Equilibrium Constant

### 1) Backward Reaction Rate Constant

Open Calculator

fx $$K_b = \frac{K_f}{K_c}$$

ex $$3.333333\text{mol/L} = \frac{200\text{mol/L}}{60\text{mol/L}}$$

### 2) Change in Number of Moles

Open Calculator

fx $$\Delta n = n_P - n_R$$

ex $$10\text{mol} = 15\text{mol} - 5\text{mol}$$

### 3) Equilibrium Concentration of Substance A

Open Calculator

fx $$Eq_{\text{conc A}} = \left( \frac{(Eq^{c}_{\text{conc C}}) \cdot (Eq^{d}_{\text{conc D}})}{K_c \cdot (Eq^{b}_{\text{conc B}})} \right)^{\frac{1}{a}}$$

ex $$5.977019\text{mol/L} = \left( \frac{\left((30\text{mol/L})^{9}\right) \cdot \left((35\text{mol/L})^{7}\right)}{60\text{mol/L} \cdot \left((0.011\text{mol/L})^{3}\right)} \right)^{\frac{1}{17}}$$

## 4) Equilibrium concentration of Substance B

Open Calculator

$$\mathrm{Eq_{conc\ B}} = \frac{\mathrm{Eq_{conc\ C}} \cdot \mathrm{Eq_{conc\ D}}}{\mathrm{K_c} \cdot \mathrm{Eq_{conc\ A}}}$$

$$0.002931\mathrm{mol/L} = \frac{30\mathrm{mol/L} \cdot 35\mathrm{mol/L}}{60\mathrm{mol/L} \cdot 5.97\mathrm{mol/L}}$$

## 5) Equilibrium Concentration of Substance C

Open Calculator

$$\mathrm{Eq_{conc\ C}} = \left( \frac{\mathrm{K_c} \cdot \left(\mathrm{Eq_{conc\ A}^{a}}\right) \cdot \left(\mathrm{Eq_{conc\ B}^{b}}\right)}{\mathrm{Eq_{conc\ D}^{d}}} \right)^{\frac{1}{c}}$$

$$29.93349\mathrm{mol/L} = \left( \frac{60\mathrm{mol/L} \cdot \left((5.97\mathrm{mol/L})^{17}\right) \cdot \left((0.011\mathrm{mol/L})^{3}\right)}{(35\mathrm{mol/L})^{7}} \right)^{\frac{1}{9}}$$

## 6) Equilibrium Concentration of Substance D

Open Calculator

$$\mathrm{Eq_{conc\ D}} = \left( \frac{\mathrm{K_c} \cdot \left(\mathrm{Eq_{conc\ A}^{a}}\right) \cdot \left(\mathrm{Eq_{conc\ B}^{b}}\right)}{\mathrm{Eq_{conc\ C}^{c}}} \right)^{\frac{1}{d}}$$

$$34.90027\mathrm{mol/L} = \left( \frac{60\mathrm{mol/L} \cdot \left((5.97\mathrm{mol/L})^{17}\right) \cdot \left((0.011\mathrm{mol/L})^{3}\right)}{(30\mathrm{mol/L})^{9}} \right)^{\frac{1}{7}}$$

## 7) Equilibrium Constant

Open Calculator

fx $$K_c = \frac{K_f}{K_b}$$

ex $$60.06006\text{mol/L} = \frac{200\text{mol/L}}{3.33\text{mol/L}}$$

## 8) Equilibrium Constant with respect to Molar Concentrations

Open Calculator

fx $$K_c = \frac{(Eq^c_{\text{conc C}}) \cdot (Eq^d_{\text{conc D}})}{(Eq^a_{\text{conc A}}) \cdot (Eq^b_{\text{conc B}})}$$

ex $$61.2105\text{mol/L} = \frac{\left((30\text{mol/L})^9\right) \cdot \left((35\text{mol/L})^7\right)}{\left((5.97\text{mol/L})^{17}\right) \cdot \left((0.011\text{mol/L})^3\right)}$$

## 9) Forward Reaction Rate Constant

Open Calculator

fx $$K_f = K_c \cdot K_b$$

ex $$199.8\text{mol/L} = 60\text{mol/L} \cdot 3.33\text{mol/L}$$

## 10) Number of Moles of Gaseous Products

Open Calculator

fx $$n_P = \Delta n + n_R$$

ex $$9\text{mol} = 4\text{mol} + 5\text{mol}$$

## 11) Number of Moles of Gaseous Reactants

Open Calculator

**fx** $$n_R = n_P - \Delta n$$

**ex** $$11\text{mol} = 15\text{mol} - 4\text{mol}$$

## 12) Variation of Equilibrium Constant with Temperature at Constant Pressure

Open Calculator

**fx** $$K_2 = K_1 \cdot \exp\left(\left(\frac{\Delta H}{[R]}\right) \cdot \left(\frac{T_2 - T_{abs}}{T_{abs} \cdot T_2}\right)\right)$$

**ex** $$0.141732 = 0.0260 \cdot \exp\left(\left(\frac{32.4\text{KJ/mol}}{[R]}\right) \cdot \left(\frac{310\text{K} - 273.15\text{K}}{273.15\text{K} \cdot 310\text{K}}\right)\right)$$

## Variables Used

- **a** Number of Moles of A
- **b** No. of Moles of B
- **c** No. of Moles of C
- **d** No. of Moles of D
- $Eq_{conc\ A}$ Equilibrium Concentration of A *(Mole per Liter)*
- $Eq_{conc\ B}$ Equilibrium Concentration of B *(Mole per Liter)*
- $Eq_{conc\ C}$ Equilibrium Concentration of C *(Mole per Liter)*
- $Eq_{conc\ D}$ Equilibrium Concentration of D *(Mole per Liter)*
- $K_1$ Equilibrium constant 1
- $K_2$ Equilibrium constant 2
- $K_b$ Backward Reaction Rate Constant *(Mole per Liter)*
- $K_c$ Equilibrium Constant *(Mole per Liter)*
- $K_f$ Forward reaction rate constant *(Mole per Liter)*
- $n_P$ Number of moles of products *(Mole)*
- $n_R$ Number of moles of reactants *(Mole)*
- $T_2$ Absolute temperature 2 *(Kelvin)*
- $T_{abs}$ Absolute Temperature *(Kelvin)*
- $\Delta H$ Heat of reaction *(KiloJoule Per Mole)*
- $\Delta n$ Change in Number of Moles *(Mole)*

## Constants, Functions, Measurements used

- Constant: **[R]**, 8.31446261815324 Joule / Kelvin * Mole
  *Universal gas constant*
- Function: **exp**, exp(Number)
  *Exponential function*
- Measurement: **Temperature** in Kelvin (K)
  *Temperature Unit Conversion*
- Measurement: **Amount of Substance** in Mole (mol)
  *Amount of Substance Unit Conversion*
- Measurement: **Molar Concentration** in Mole per Liter (mol/L)
  *Molar Concentration Unit Conversion*
- Measurement: **Energy Per Mole** in KiloJoule Per Mole (KJ/mol)
  *Energy Per Mole Unit Conversion*

## Check other formula lists

- **Equilibrium Constant Formulas**
- **Properties of Equilibrium Constant Formulas**
- **Relation between Equilibrium Constant and Degree of Dissociation Formulas**
- **Relation between Vapour Density and Degree of Dissociation Formulas**
- **Thermodynamics in Chemical Equilibrium Formulas**

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