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# **whalogen v0.3.0**

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## Quick Start Guide

```
#import "@preview/whalogen:0.2.0": ce
```

This is the formula for water: `#ce("H2O")`

This is a chemical reaction:

```
#ce("CO2 + C -> 2CO")
```

It can be placed inside an equation: `$#ce("CO2 + C -> 2CO")$`

It can be placed on its own line:

```
$
```

```
#ce("CO2 + C -> 2CO")
```

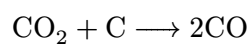
```
$
```

This is the formula for water:  $\text{H}_2\text{O}$

This is a chemical reaction:  $\text{CO}_2 + \text{C} \longrightarrow 2\text{CO}$

It can be placed inside an equation:  $\text{CO}_2 + \text{C} \longrightarrow 2\text{CO}$

It can be placed on its own line:



## Introduction

This package is designed to facilitate the typesetting of chemical formulas in Typst. It mainly aims to replicate the functionality and operation of LaTeX's mhchem package. However, there are naturally some differences in the implementation of some features.

All of the features of this package are designed to function in both text and math mode.

## Chemical Equations

$\text{CO}_2 + \text{C} \longrightarrow 2\text{CO}$

```
#ce("C02 + C -> 2C0")
```

## Chemical Formulae

$\text{H}_2\text{O}$

```
#ce("H20")
```

$\text{Sb}_2\text{O}_3$

```
#ce("Sb203")
```

## Charges

$\text{H}^+$

```
#ce("H+")
```

$\text{CrO}_4^{2-}$

```
#ce("Cr04^2-")
```

$[\text{AgCl}_2]^-$

```
#ce("[AgCl2] -")
```

$\text{Y}^{99+}$

```
#ce("Y^99+")
```

The en-dash (–) will be used for minus.

## Oxidation States

$\text{Fe}^{\text{II}}\text{Fe}_2^{\text{III}}\text{O}_4$

```
#ce("Fe^II Fe^III_2O4")
```

A caret (^) will imply that subsequent characters should be in the superscript unless interrupted by certain characters (i.e. whitespace and underscore).

## Oxidation Numbers (RedOx Reaction Syntax)

$\overset{+II}{\text{Mn}} + \overset{+I}{\text{H}_2}\overset{-I}{\text{O}_2} \longrightarrow \overset{+IV}{\text{Mn}}\overset{-II}{\text{O}_2} + \overset{+I}{\text{H}_2}\overset{-II}{\text{O}}$

```
#ce("|Mn,+II| + |H2,+I||O2,-I| -> |Mn,+IV||O2,-II| + |H2,+I||O,-II|")
```

Wrapping an element X with vertical bars like this: |X,Y| will ensure that Y is placed above X. Make sure to not include any spaces or you may get unintended behavior. Also ensure that anything that should affect the element (for example the 2 in  $\text{H}_2$ ) is placed inside the bars.

## Unpaired Electrons and Radical Dots

$\text{OCO}^{\bullet-}$  `#ce("OCO^.-")`

$\text{NO}^{2\bullet-}$  `#ce("NO^2.-")`

## Stoichiometric Numbers

$2\text{H}_2\text{O}$  `#ce("2H2O")`

$2\text{H}_2\text{O}$  `#ce("2 H2O")`

$0.5\text{H}_2\text{O}$  `#ce("0.5H2O")`

$\frac{1}{2}\text{H}_2\text{O}$  `#ce("1/2H2O")`

The behavior of the fraction line is inherited from Typst's default behavior and generally obeys the rules for grouping numbers and automatically removing parenthesis.

When whitespace is inserted between the stoichiometric number and a compound with a subscript, the whitespace is automatically trimmed. If there is no subscript, the whitespace is not trimmed. This is a characteristic of Typst.

$2\text{ CO}$  `#ce("2 CO")`

## Nuclides, Isotopes

$^{227}_{90}\text{Th}^+$  `#ce("@Th,227,90@^+")`

$^0_{-1}\text{n}^-$  `#ce("@n,0,-1@^-")`

$^{99\text{m}}\text{Tc}$  `#ce("@Tc,99m,@")`

To simplify implementation of the parser, this string pattern is introduced to specify nuclides and isotopes. This is different from mhchem.

## Parenthesis, Brackets, Braces

$(\text{NH}_4)_2\text{S}$  `#ce("(NH4)2S")`

The parenthesis, brackets, and braces will automatically size to match the inner content.

$\left[\left\{\left(\text{X}_2\right)_3\right\}_2\right]^{3+}$  `#ce("[{(X2)3}2]^3+")`

## Reaction Arrows

$A \longrightarrow B$  `#ce("A -> B")`

$A \longleftarrow B$  `#ce("A <- B")`

$A \longleftrightarrow B$  `#ce("A <-> B")`

$A \rightleftharpoons B$  `#ce("A <- -> B")`

$A \rightleftharpoons B$  `#ce("A <=> B")`

These reaction arrows come from the built-in `sym` module.

It is also possible to include text above the arrow. The backend uses the `xarrow` package to resize the arrows and place respective text.

$A \xrightarrow{\text{H}_2\text{O}} B$  `#ce("A ->[H2O] B")`

$A \xrightarrow{\text{some text}} B$  `#ce("A ->[some text] B")`

$A \xrightarrow[\text{other text}]{\text{some text}} B$  `#ce("A ->[some text][other text] B")`

## States of Aggregation

$\text{H}_2(\text{aq})$  `#ce("H2(aq)")`

$\text{NaOH}(\text{aq}, \infty)$  `#ce("NaOH(aq, #sym.infinity)")`

In Typst, when parenthesis and similar follow a subscript, it is also included in the subscript. This results in seemingly different behavior for very similar input as seen above. The  $\text{H}_2$  has an implied underscore whereas the  $\text{NaOH}$  does not.

To achieve the opposite behavior as shown above, insert whitespace or underscore respectively.

$\text{H}_2(\text{aq})$  `#ce("H2 (aq)")`

$\text{NaOH}_{(\text{aq}, \infty)}$  `#ce("NaOH_(aq, #sym.infinity)")`

## Variables

$\text{H}_2\text{O} \xrightleftharpoons[k_{-1}]{k_1} \text{OH}^- + \text{H}^+$  `#ce("H2O <=>[$k_1$][$k_{-1}$] OH- + H+")`

$x \text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_x\text{H}_{(2-x)}\text{SO}_4$  `#ce("$x$ NaOH + H2SO4 = Na_{$x$} H_{(2-x)}SO4")`

Sometimes it is needed to use variables in mathematical notation (i.e. italic). This is possible by using the equation delimiter `$...$` inside `ce()`.

## Further Examples

ce is a function that takes string input and returns a content block. As such, it can interact with the same rules as other content blocks in math mode.

Example to calculate  $K_a$ :

```
$
K_a = (#h(1.3em) [#ce("H+")] overbrace(#ce("[A-]"), "conjugate acid"))/
underbrace(#ce("[HA]"), "acid")
$
```

Using ``ce`` in limit text:

```
$
lim_#ce("[H+] -> #sym.infinity") K_a = #sym.infinity
$
```

Aligning multiple equations:

```
$
#ce("H2SO4 (aq) <=> H+ (aq) + HSO4^- (aq)")\
#ce("H+ (aq) + HSO4^- (aq) <=> H2SO4 (aq)")
$
```

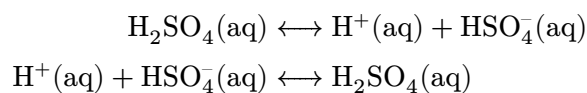
Example to calculate  $K_a$ :

$$K_a = \frac{[\text{H}^+] \overbrace{[\text{A}^-]}^{\text{conjugate acid}}}{\underbrace{[\text{HA}]}_{\text{acid}}}$$

Using ce in limit text:

$$\lim_{[\text{H}^+] \rightarrow \infty} K_a = \infty$$

Aligning multiple equations:



## Appendix

### Under the Hood

This package works by parsing the provided simple text input and converting it into Typst equation input. In general, inserting whitespace will reset the parser's state machine. If there is still some strange behavior, the underlying Typst output can be inspected by setting the debug flag:

```
"H" _ "2" ("aq")
```

```
#ce("H2(aq)", debug: true)
```