Standardization and Symbols

•Symbols in chemistry are standardized internationally.

•The International Union of Pure and Applied Chemistry (IUPAC) founded in 1919 (101 years ago)

•American Chemical Society (ACS) founded 1876 (144 years ago)

•Royal Society of Chemistry (RSC) predecessor was founded in 1844 (176 years ago)

•ACS and RSC both have standards and symbols committees which interact with the IUPAC.

•Our recommendations are to use IUPAC abbreviations for chemical symbols and expressions along with naming conventions and standards.

•Standards and examples can be found in the CRC handbook (100th ed. 1532 pages).
.Proposed "wrappers" for chemistry in MathML

•**"Chemical equation"**
•Sub-wrapper : **"organic chemistry"**

•Sub-wrapper : **"biochemistry"**

•These are specialized abbreviations that are sub-field specific and go beyond the IUPAC element symbols

•**"Chemistry"** equations that use chemical concepts that require a consistent "character"

•**"Units"**

•**"Chemical formulas"** (used in other equations)
•Sub-wrapper : **"organic chemistry"**

•Sub-wrapper : **"biochemistry"**

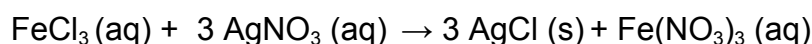•These are specialized abbreviations that are sub-field specific and go beyond the IUPAC element symbols

Chemical equations are different from mathematical equations

•Chemical equations have a different form than mathematical equations.

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•This is what we call a "balanced chemical equation"

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$$FeCl_3 \text{ (aq)} + 3\ AgNO_3 \text{ (aq)} \rightarrow 3\ AgCl \text{ (s)} + Fe(NO_3)_3 \text{ (aq)}$$

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•We suggest this would be identified as a chemical equation using a "wrapper" which would be read as…

- "cap F e cap C l sub 3 aqueous Plus 3 Cap A g Cap N Cap O sub 3 aqueous reacts to form 3 Cap A g Cap C l solid Plus Cap F e open paren Cap N Cap O sub 3 close paren sub 3 aqueous

Simple Expressions in Chemistry : PV=nRT

- Simple algebraic expressions can be handled by using the content wrapper "chemistry"

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- PV=nRT

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- Contextual knowledge and the text of a book or webpage will allow the student know that this expression is the ideal gas law and means "pressure times volume is equal to the number of moles of an ideal gas times the universal gas constant times temperature in Kelvin"

- The speech engine should render this as "Cap P times Cap V equals n times Cap R times Cap T

Chemical formulas often appear in algebraic expressions

$K_{eq} = ([CH_2=CH_2][HBr])/([CH_2 Br-CH_3])$

- This example is of an equilibrium expression. In this case, three chemical species have their concentrations, denoted by chemical formulas within square brackets, within an algebraic expression.

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- This would be rendered as "Cap K sub eq equals the concentration of Cap C Cap H sub 2 double bond Cap C Cap H sub 2 times the concentration of Cap H Cap B r divided by the concentration of Cap C Cap H sub 2 Cap B r single bond Cap C Cap H sub 3"

Conclusions

Chemical equations and chemical formulas are NOT the same thing and must be treated differently.
Chemical equations have different formalisms than mathematical equations.
Chemical formulas are commonly used in algebraic expressions.
Equations used in chemistry have common features or "characters" that should be pronounced in a specific way for the purposes of disambiguation and convention.
Units must have their own tag for disambiguation

Organic Chemistry and Biochemistry need their own wrappers / sub-wrappers due to specialized abbreviations.