LaTeX: A Guide for the Curious Chemist

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Contents

Chapter 1

Why LaTeX for Chemistry?

1.1 What LaTeX Can Do for Chemists

LaTeX is a typesetting system trusted by scientists, engineers, and publishers for producing technical and scientific documents. For chemists, it offers unparalleled control over:

- **Chemical Equations:** With the `mhchem` package, write reactions cleanly: `\ce{CH4 + 2 O2 -> CO2`
- **Structural Diagrams:** Use `chemfig` to draw molecules and mechanisms.
- **Data Tables and Units:** Integrate with `siunitx` for consistent formatting of quantities and units.
- **Professional Layouts:** Reports, theses, and posters with clean typography and logical structure.

1.2 Why Not Use Word Processors?

While Microsoft Word or Google Docs may seem familiar, they have serious limitations:

- Tedious formatting for reactions and diagrams
- Inconsistent styling and broken equation rendering
- Weak version control and collaboration features
- Poor support for citations, referencing, and scientific packages

LaTeX solves these by allowing you to focus on *content*, not formatting. Once learned, it saves time and raises the quality of your work.

1.3 Who Should Learn It: Chem Students, Researchers, and Educators

LaTeX isn't just for grad students. You'll benefit from it if you:

- Write lab reports with equations, spectra, or mechanisms
- Submit articles to journals or conferences
- Collaborate on research or review scientific literature
- Teach chemistry and want to share clear, reproducible materials

Even undergraduates can use LaTeX for better grades and clearer thinking.

1.4 Tools of the Trade: Overleaf, MiKTeX, TeXstudio

Overleaf (Recommended for Beginners)

- Free, cloud-based LaTeX editor
- Requires no installation
- Real-time collaboration and preview
- Supports `mhchem`, `chemfig`, and all major chemistry packages

`https://www.overleaf.com`

Local Installation (for Offline Work)

- **MiKTeX** (Windows), **MacTeX** (Mac), or **TeX Live** (Linux)
- Editors: **TeXstudio**, **VSCode with LaTeX Workshop**, or **TeXmaker**

1.5 Your First Chemical Document

Try compiling this in Overleaf:

```
\documentclass{article}
\usepackage[version=4]{mhchem}
\begin{document}
```

```
A basic chemical reaction:

\[
\ce{CH4 + 2 O2 -> CO2 + 2 H2O}
\]

\end{document}
```

$$\mathrm{CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O}$$

Try This!

- Change the reaction to a combustion of ethanol.
- Make it reversible using `<=>`.
- Add states of matter: `(g)`, `(l)`, etc.

Lab Tip

Most journals and safety documents use LaTeX for reproducibility — even safety data sheets (SDS) and chemical databases often export to ‘.tex‘ for archiving.

What's Next

Now that you know why LaTeX is worth learning, let's dive into how to structure chemistry documents in Chapter 2.

Chapter 2

Document Structure for Chemistry Reports

2.1 Title Pages, Abstracts, and Sectioning

Chemistry documents — especially lab reports and research papers — follow a predictable structure. Here's a basic outline:

- Title
- Author and Date
- Abstract
- Introduction
- Experimental Section
- Results and Discussion
- Conclusion
- References

You can use ‘‘ for simple title formatting, or create a custom one for lab reports.

Example:

```
\documentclass[12pt]{article}
\usepackage[version=4]{mhchem}
```

```
\title{Synthesis of Aspirin}
\author{Nishtha Tikalal}
\date{March 5, 2025}
\begin{document}
\maketitle
```

Add an abstract:

```
\begin{abstract}
This experiment demonstrates the synthesis of acetylsalicylic acid (aspirin) from salicy
\end{abstract}
```

2.2 Writing Lab Reports and Research Papers

A good lab report should be reproducible. Use clear headings with

`‘\section‘, ‘\subsection‘, and optionally ‘\paragraph‘.`

```
\section{Introduction}
Aspirin is widely used as an analgesic...

\section{Experimental}
\subsection{Materials}
\subsection{Procedure}

\section{Results and Discussion}
\subsection{Reaction Equation}
\subsection{Yield and Purity}
```

Chemist’s Best Practices

- Use consistent section naming: avoid mixing “Methods” and “Procedure”
- Keep units and sig figs accurate (see ‘siunitx‘ in Chapter 4)
- Include equations and structures when relevant

2.3 Page Setup and Formatting

For clean margins and readable text:

```
\usepackage{geometry}
\geometry{margin=1in}
\usepackage{setspace}
\onehalfspacing
```

Turn off indenting if needed:

```
\usepackage{parskip}
```

Add page numbers and headers:

```
\usepackage{fancyhdr}
\pagestyle{fancy}
\fancyhf{}
\fancyhead[L]{Your Name}
\fancyhead[R]{Chem 204 Report}
\fancyfoot[C]{\thepage}
```

2.4 Best Practices for Scientific Reports

- **No first-person:** Write objectively ("The solution was heated...").
- **Cite sources:** Include references to protocols or journal articles.
- **Label all equations and figures.**
- **Use LaTeX environments:** Don't manually bold or align.
- **Define commands:** e.g., `\newcommand{\aspirin}{\ce{C9H8O4}}`

Try This!

Create a one-page lab summary with the following structure:

- Title + abstract
- Reaction equation using ‘‘ from ‘mhchem‘
- A table of reagents
- A concluding sentence

What's Next

In Chapter 3, we'll explore how to write chemical formulas and reactions using 'mhchem' — the foundation of chemistry in LaTeX.

Chapter 3

Chemical Equations and Reactions in LaTeX

3.1 Using the `mhchem` Package

Load the package in your preamble:

```
\usepackage[version=4]{mhchem}
```

Use the ‘‘ command to write chemical expressions inside text or equations. It parses the chemical syntax automatically.

Example:

```
\ce{H2O}, \ce{CO2}, \ce{NaCl}, \ce{H+}
```

Which renders as: H_2O, CO_2, NaCl, H^+

3.2 Writing Chemical Formulas and Reactions

Use ‘‘ for both individual molecules and full equations:

```
\ce{CH4 + 2 O2 -> CO2 + 2 H2O}
```

$$CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O$$

Reversible Reactions

```
\ce{CO2 + H2O <=> H2CO3}
```

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

3.3 Isotopes, Charges, and States of Matter

Isotopes:

```
\ce{^{14}C}, \ce{^{18}O}, \ce{_{3}^{7}Li+}
```

^{14}C, ^{18}O, $^{7}_{3}Li^{+}$

Charges:

```
\ce{Na+}, \ce{SO4^2-}, \ce{NH4+}
```

Na^{+}, $SO_4{}^{2-}$, $NH_4{}^{+}$

States of Matter:

```
\ce{H2O(l)}, \ce{O2(g)}, \ce{NaCl(s)}
```

$H_2O(l)$, $O_2(g)$, $NaCl(s)$

3.4 Arrows and Reaction Conditions

Arrows:

- `->` $\rightarrow$ irreversible reaction
- `<=>` $\rightarrow$ equilibrium
- `<-` $\rightarrow$ reverse reaction

Conditions:

```
\ce{N2 + 3 H2 ->[Fe catalyst] 2 NH3}
```

$$N_2 + 3\,H_2 \xrightarrow{\text{Fe catalyst}} 2\,NH_3$$

Temperature/Pressure:

```
\ce{C + O2 ->[\Delta] CO2}
\ce{2 H2O2 ->[MnO2][heat] 2 H2O + O2}
```

$$2\,H_2O_2 \xrightarrow[\text{heat}]{MnO_2} 2\,H_2O + O_2$$

3.5 Practice Examples and Common Mistakes

- `\ce{Ag+ + Cl- -> AgCl(v)}`
- `\ce{Ag+ + Cl- --> AgCl}` ← Do not use '–>'
- `\ce{H2SO4 + 2 NaOH -> Na2SO4 + 2 H2O}`

Try This!

- Write a neutralization reaction with charges and states.
- Convert a combustion equation to include `\Delta`.
- Include a reversible reaction with a catalyst above the arrow.

Lab Tip

Using `\ce{}` ensures your equations follow journal conventions. Most chemistry journals now support 'mhchem'-style syntax for reaction schemes and balances.

What's Next

Now that you can typeset chemical reactions, Chapter 4 will show how to present experimental data using tables, units, and significant figures.

Chapter 4

Tables and Data Presentation

4.1 The `tabular` Environment for Data Tables

Tables are essential for reporting yields, melting points, masses, concentrations, and spectral data. The ‘tabular‘ environment gives precise control.

Example:

```
\begin{tabular}{|l|c|r|}
\hline
Compound & Mass (g) & Yield (\%) \\
\hline
Aspirin & 2.50 & 85 \\
Acetanilide & 1.20 & 60 \\
\hline
\end{tabular}
```

Compound	Mass (g)	Yield (%)
Aspirin	2.50	85
Acetanilide	1.20	60

4.2 Long Tables and Multirow/Multicolumn Cells

Use ‘longtable‘, ‘multirow‘, and ‘multicol‘ for more complex layouts, especially for inventories or spectral tables.

Example:

```
\usepackage{multirow}
...
\begin{tabular}{|l|c|c|}
\hline
\multirow{2}{*}{Compound} & \multicolumn{2}{c|}{IR (cm\textsuperscript{-1})} \\
\cline{2-3}
& Stretch A & Stretch B \\
\hline
Benzene & 1600 & 1500 \\
\hline
\end{tabular}
```

4.3 Units and Significant Figures with `siunitx`

‘`siunitx`‘ helps ensure consistent formatting of quantities, units, and sig figs.

Setup:

```
\usepackage{siunitx}
\sisetup{round-mode=places, round-precision=2}
```

Examples:

- `\SI{1.23}{\gram}` → 1.23
- `\SI{0.045}{\milli\liter}` → 0.045
- `\SI{273.15}{\kelvin}` → 273.15

4.4 Chemical Inventory and Safety Tables

You can format safety and inventory sheets using clear, aligned tables:

Chemical	Amount	Hazard	PPE Required
H_2SO_4	25	Corrosive	Gloves, goggles
NaOH	2.5	Irritant	Gloves

Try This!

- Create a reagent list with chemical name, formula (using ‘‘), and mass (using ‘‘).
- Format a spectral table with multicolumn headers.
- Use ‘longtable‘ to split tables across pages.

Lab Tip

Most lab report errors come from inconsistent units and sig figs. Use ‘siunitx‘ for all values — even in captions or inline text — to avoid mistakes.

What’s Next

In Chapter 5, you’ll learn how to draw molecular structures, mechanisms, and organic reaction schemes using ‘chemfig‘ — a visual upgrade to your chemistry typesetting.

Chapter 5

Structural Diagrams and Schemes

5.1 Introduction to the `chemfig` Package

`chemfig` lets you draw molecules and reaction mechanisms using LaTeX code. Load it in your preamble:

```
\usepackage{chemfig}
```

Basic Syntax:

```
\chemfig{CH_3-CH_2-OH}
```

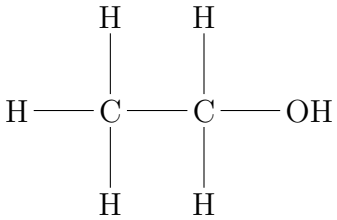
$CH_3 — CH_2 — OH$

Use underscores `_` for subscripted atoms, dashes `-` for bonds, and parentheses for branching.

5.2 Drawing Simple Molecules

Examples:

```
\chemfig{H-C(-[2]H)(-[6]H)-C(-[2]H)(-[6]H)-OH}  % Ethanol
```

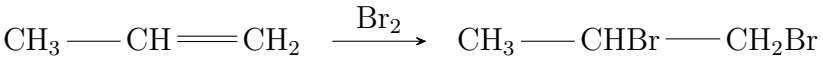



```
\chemfig{CH_3-CH(-OH)-COOH}  % Lactic Acid
```

5.3 Creating Reaction Mechanisms

Use arrows to show mechanisms or synthetic steps:

```
\schemestart
\chemfig{CH_3-CH=CH_2}
\arrow{->[\ce{Br2}]}
\chemfig{CH_3-CHBr-CH_2Br}
\schemestop
```

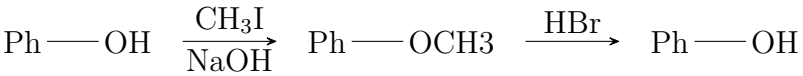


You can also chain multi-step syntheses with `\arrow{->}`

5.4 Organic Reaction Schemes

Use nodes and multiple reactions:

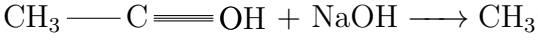
```
\schemestart
\chemfig{Ph-OH}
\arrow{->[\ce{CH3I}][\ce{NaOH}]}
\chemfig{Ph-OCH3}
\arrow{->[\ce{HBr}]}
\chemfig{Ph-OH}
\schemestop
```



5.5 Combining `chemfig` and `mhchem`

You can annotate structures with reactions and conditions:

```
\chemfig{CH_3-C(=O)-OH} + \ce{NaOH -> CH3COONa + H2O}
```



Try This!

- Draw acetic acid, aspirin, and ethanol.
- Create a two-step esterification reaction with arrows.
- Add curved arrows or lone pairs (see ‘chemmacros‘ for advanced visuals).

Lab Tip

For complex reactions, break your code into macros or external files and `\input` them. Use Overleaf’s TikZ preview feature if needed.

What’s Next

Now that you can draw molecules and reactions, Chapter 6 introduces how to typeset spectral and analytical chemistry data (NMR, IR, MS) using clean, consistent LaTeX layouts.

Chapter 6

Spectroscopy and Analytical Data

6.1 NMR Notation and Formatting

To typeset ^{1}H or ^{13}C NMR data, use math mode or 'mhchem' for clarity:

```
\ce{^{1}H NMR} (400 MHz, CDCl3) \delta 7.26 (d, J = 8.0 Hz, 2H), ...
```

^{1}H NMR (400 MHz, CDCl3) δ 7.26 (d, J = 8.0 Hz, 2H)

For delta values, always use math mode: `$\delta$ 7.26`

Inline Format:

```
\ce{^{13}C NMR} (100 MHz, DMSO-d6) $\delta$ 167.2, 132.5, 128.9
```

6.2 Infrared (IR) Spectra

Use `siunitx` for wavenumbers and notation:

```
\ce{IR} (film): \SI{1715}{\per\centi\meter}, \SI{1600}{\per\centi\meter} (C=O, C=C)
```

IR (film): 1715, 1600 (C=O, C=C)

6.3 Mass Spectrometry (MS)

Typical MS data includes m/z and ion identification:

```
MS (ESI): m/z 303 [M+H]+, 325 [M+Na]+
```

Use square brackets for fragments and ion notation consistently.

6.4 UV-Vis Spectroscopy

You can include $\lambda_{\max}$ using math mode:

```
UV-Vis (EtOH): $\lambda_{\max}$ = 285 nm, 330 nm
```

6.5 Sample Descriptions and Integration in Reports

- Use concise summary tables for analytical data.
- Embed data after compound names in the Experimental section.
- Format consistent with journal standards.

Example Analytical Entry

> **Compound A.** ^{1}H NMR (400 MHz, CDCl3) δ 7.25 (s, 1H), 3.85 (s, 3H). IR (film): 1720. HRMS (ESI): m/z 302.1234 [M+H]+.

6.6 Inline Spectral Assignments

Use LaTeX math mode or superscripts for clear peak labeling:

```
The singlet at $\delta$ 3.85 was assigned to OCH3 protons.
```

Try This!

- Write an NMR description with coupling constants and multiplicity.
- Include $\lambda_{\max}$ with proper units.
- Format a brief MS report with exact mass values.

Lab Tip

Keep a personal ‘.tex‘ macro for compound-specific data. This speeds up writing and ensures consistency across experiments.

What's Next

In Chapter 7, we'll combine your LaTeX math skills with chemistry — covering thermodynamics, kinetics, and equilibrium equations.

Chapter 7

Mathematical Chemistry and Equations

7.1 Thermodynamic Equations

Many thermodynamic relationships involve Greek letters, partial derivatives, and fractions. Use ‘amsmath‘ for environments and spacing.

Example: Gibbs Free Energy

```
\[
\Delta G = \Delta H - T\Delta S
\]
```

$$\Delta G = \Delta H - T\Delta S$$

Entropy Change:

$$\Delta S = \int \frac{dq_{\text{rev}}}{T}$$

Use subscripts like `q_{\text{rev}}` and integral signs with care.

7.2 Kinetics and Rate Laws

Rate laws are commonly used in chemical kinetics:

First-Order:

$$\frac{d[A]}{dt} = -k[A]$$

Integrated:

$$\ln[A] = -kt + \ln[A]_0$$

Use brackets for concentrations: `[A]` and natural logs in `\ln` form.

7.3 Equilibrium and Constants

Equilibrium constants are typeset using fractions or brackets:

$$K = \frac{[\mathrm{C}][\mathrm{D}]}{[\mathrm{A}][\mathrm{B}]}$$

Combine ‘mhchem‘ with math mode:

```
\[
K = \frac{[\ce{C}][\ce{D}]}{[\ce{A}][\ce{B}]}
\]
```

7.4 Using `amsmath` and `mathtools`

Use ‘align‘ for multi-step derivations:

```
\begin{align}
\Delta G &= \Delta G^\circ + RT \ln Q \\
         &= -RT \ln K \quad \text{at equilibrium}
\end{align}
```

$$\begin{aligned}
\Delta G &= \Delta G^\circ + RT \ln Q && (7.1)\\
&= -RT \ln K \quad \text{at equilibrium} && (7.2)
\end{aligned}$$

Use `\text{}` for words inside equations.

Try This!

- Write the Nernst equation with all terms and units.
- Derive the integrated rate law using ‘align‘.
- Display K_p and K_c using math and chemistry syntax.

Lab Tip

Don’t cram equations into paragraphs. Use display math for clarity, and always label your steps in multi-line derivations.

What’s Next

In Chapter 8, you’ll learn how to manage references, DOIs, and chemical citations using BibTeX and chemistry-specific bibliography styles.

Chapter 8

Bibliographies and Referencing for Chemists

8.1 Citing Chemical Journals and Standards

Chemistry papers follow strict citation formats, often numbered or author-year. You can use either:

- `biblatex` (modern, flexible)
- `natbib` (older, still accepted)

8.2 Using `biblatex` for Chemistry

```
\usepackage[style=numeric, backend=biber]{biblatex}
\addbibresource{references.bib}
```

In your text:

```
\cite{smith2020}
```

8.3 Sample BibTeX Entry for a Journal Article

Your ‘references.bib‘ might contain:

```
@article{smith2020,
  author  = {John Smith and Jane Doe},
```

```
  title   = {New Catalysts for Suzuki Coupling},
  journal = {J. Org. Chem.},
  year    = {2020},
  volume  = {85},
  number  = {2},
  pages   = {123--130},
  doi     = {10.1021/acs.joc.0c00123}
}
```

8.4 Integration with DOI, Scopus, and PubChem

You can fetch citation entries using:

- Google Scholar → Cite → BibTeX
- ChemSpider → Export Citation
- CrossRef → DOI Metadata Search

8.5 Chem-Specific Styles: `achemso`

To follow ACS formatting guidelines:

```
\usepackage[numbers,super,sort&compress]{natbib}
\bibliographystyle{achemso}
\bibliography{refs}
```

Produces superscripted references: Smith[1]

Try This!

- Add a journal article and a book to your ‘.bib‘ file.
- Cite both in a sample paragraph.
- Test both ‘biblatex‘ and ‘natbib‘ styles to see formatting differences.

Lab Tip

Save DOIs with each reference. Use BibTeX managers (like JabRef or Zotero) to organize sources, especially for large reports or theses.

What's Next

Next, we'll create scientific presentations and posters with Beamer in Chapter 9 — including molecules, reactions, and animations.

Chapter 9

Presenting Chemistry with Beamer

9.1 Making Presentations with `beamer`

`beamer` is a LaTeX class that lets you create elegant presentations directly from LaTeX — ideal for research talks, poster previews, or lab group meetings.

Basic Setup:

```
\documentclass{beamer}
\usepackage[version=4]{mhchem}
\usepackage{chemfig}
\usetheme{Madrid}

\title{Nitration of Benzene}
\author{Nishtha Tikalal}
\date{\today}

\begin{document}
\frame{\titlepage}
```

9.2 Highlighting Structures and Reactions

Use ‘chemfig‘ and ‘mhchem‘ inside frames just like in articles:

```
\begin{frame}{Reaction Overview}
```

```
\ce{C6H6 + HNO3 ->[\ce{H2SO4}] C6H5NO2 + H2O}
\end{frame}

\begin{frame}{Mechanism}
\schemestart
\chemfig{*6(=-=-=)}  % Benzene
\arrow{->[\ce{NO2+}]}
\chemfig{*6(-=-(-NO2)-=-)}
\schemestop
\end{frame}
```

9.3 Blocks and Emphasis

`beamer` blocks help organize content:

```
\begin{block}{Experimental Goal}
To synthesize nitrobenzene via electrophilic aromatic substitution.
\end{block}

\begin{alertblock}{Safety Note}
Sulfuric acid is highly corrosive. Wear goggles and gloves.
\end{alertblock}
```

9.4 Best Practices for Scientific Posters

Use the ‘beamerposter‘ package for posters. Keep slides clean:

- One idea per slide
- Use bullet points
- Visuals > text

Example Frame Layout:

```
\begin{frame}{Spectral Data}
\begin{itemize}
    \item \ce{^{1}H NMR} (400 MHz): $\delta$ 7.2-8.0
    \item IR: \SI{1530}{\per\centi\meter} (NO2 stretch)
```

```
    \item MS: m/z 123 [M+H]+
\end{itemize}
\end{frame}
```

Try This!

- Create a 3-slide Beamer presentation: Reaction, Mechanism, Spectra
- Use ‘pause‘ to reveal points step by step
- Add a molecule drawing with ‘chemfig‘

Lab Tip

Use “ to reveal steps in a mechanism slowly. Avoid crowded slides — use diagrams instead of blocks of text.

What’s Next

In Chapter 10, we’ll show how to collaborate, version-control, and publish your chemistry work using Overleaf, Git, and chemistry-specific archives.

Chapter 10

Collaborating and Publishing Chem Work

10.1 Writing for Chemistry Journals

Most chemistry journals — ACS, RSC, Wiley — accept or require LaTeX. Each may supply a class file or template (e.g., `achemso.cls`).

- **ACS Journals**: Use `achemso` package
- **RSC Journals**: Some use modified `article`
- **Elsevier**: Use `elsarticle`

10.2 Working with Co-authors and Overleaf

Overleaf allows real-time collaboration:

- Share by email or link (read/write)
- Comment inline and view version history
- Use Git for offline editing (`git clone https://git.overleaf.com/project`)

Best Practices:

- Agree on file naming and structure early
- Track edits using `\added`, `\deleted` (via `changes` package)

- Use one ‘.bib‘ file for all references

10.3 Exporting to ChemRxiv or arXiv

You can submit to ChemRxiv for preprints. Ensure:

- All files (including images, ‘.bib‘, class files) are included in a ZIP
- Compile with ‘pdflatex‘ — avoid custom TikZ styles or unsupported packages
- No missing references or undefined labels

ChemRxiv Submission Checklist:

- PDF preview compiles correctly
- Abstract is well-formatted
- Author info included in header or metadata

10.4 Templates for Reports, Posters, Theses

Lab Report:

See Chapter 12 for a complete template with abstract, sections, and tables.

Poster Template (with `beamerposter`):

Ideal for conference presentations — supports columns, headers, and chemistry-specific content.

Thesis Template:

Includes front matter, chapters, bibliography, appendix. Use your university's LaTeX class if available.

Try This!

- Upload your final PDF to ChemRxiv with proper metadata
- Create a private Overleaf project and invite a lab partner

- Clone your Overleaf repo locally and push via Git

Lab Tip

For long-term research projects, use a Git-based LaTeX structure with folders for images, data, and ‘.tex‘ files. Back up often!

What’s Next

In Chapter 11, we summarize the most important commands and symbols in a cheat sheet for quick reference.

Chapter 11

Chemistry LaTeX Cheat Sheet

Quick Commands with `mhchem`

`\ce{H2O}`	$\ce{H2O}$
`\ce{Na+}`	$\ce{Na+}$
`\ce{Cl^-}`	$\ce{Cl^-}$
`\ce{SO4^{2-}}`	$\ce{SO4^{2-}}$
`\ce{H2 + O2 -> H2O}`	$\ce{H2 + O2 -> H2O}$
`\ce{A <=> B}`	$\ce{A <=> B}$
`\ce{CO2(g)}`	$\ce{CO2(g)}$

Structural Chemistry with `chemfig`

`\chemfig{CH_3-CH_2-OH}`	$\chemfig{CH_3-CH_2-OH}$
`\chemfig{CH_3-C(=O)-OH}`	$\chemfig{CH_3-C(=O)-OH}$
`\schemestart ... \schemestop`	Reaction mechanisms

Units and Quantities with `siunitx`

`\SI{1.23}{\gram}`	$\SI{1.23}{\gram}$
`\SI{250}{\milli\liter}`	$\SI{250}{\milli\liter}$
`\SI{1715}{\per\centi\meter}`	$\SI{1715}{\per\centi\meter}$

Math Physical Chemistry Notation

`\Delta G = \Delta H - T\Delta S`	$\Delta G = \Delta H - T\Delta S$
`\frac{d[A]}{dt} = -k[A]`	$\frac{d[A]}{dt} = -k[A]$
`K = \frac{[C][D]}{[A][B]}`	$K = \frac{[C][D]}{[A][B]}$
`\ln[A] = -kt + \ln[A]_0`	$\ln[A] = -kt + \ln[A]_0$

Referencing and Citation

`\cite{smith2020}`	[1] (with `biblatex`)
`\textcite{smith2020}`	Smith (2020)
`\printbibliography`	Print bibliography (biblatex)

Other Helpful Environments

- `equation`, `align` — for mathematical layout
- `tabular`, `longtable` — for data tables
- `figure`, `table` — for captions and labels
- `block`, `alertblock` — for slides

Symbols and Notation

`\Delta`	Δ
`\lambda_{\max}`	$\lambda_{\max}$
`\ce{^{13}C}`	$^{13}\mathrm{C}$
`\SI{}{}`	Scientific units
`\chemfig{}`	Molecule diagrams

What's Next

In the final chapter, Chapter 12, you'll receive complete templates for lab reports, Beamer slides, and thesis documents — ready for your chemistry coursework or research.

Chapter 12

Templates for Chemists

12.1 Lab Report Template

```
\documentclass[12pt]{article}
\usepackage[utf8]{inputenc}
\usepackage[version=4]{mhchem}
\usepackage{siunitx}
\usepackage{geometry}
\usepackage{graphicx}
\usepackage{chemfig}
\usepackage{fancyhdr}
\usepackage{amsmath}
\geometry{margin=1in}
\pagestyle{fancy}
\fancyhf{}
\fancyhead[R]{Chem 204}
\fancyhead[L]{Your Name}
\fancyfoot[C]{\thepage}

\title{Synthesis of Aspirin}
\author{Nishtha Tikalal}
\date{April 2025}

\begin{document}
```

```
\maketitle

\begin{abstract}
This experiment demonstrates the synthesis of aspirin from salicylic acid and acetic anh
\end{abstract}

\section{Introduction}
\ce{C7H6O3 + C4H6O3 -> C9H8O4 + CH3COOH}

\section{Experimental}
\subsection{Materials}
\begin{itemize}
  \item \ce{C7H6O3} (Salicylic Acid)
  \item \ce{C4H6O3} (Acetic Anhydride)
  \item \ce{H2SO4} catalyst
\end{itemize}

\subsection{Procedure}
Salicylic acid was dissolved in acetic anhydride and heated with a few drops of sulfuric

\section{Results and Discussion}
\subsection{Yield}
\SI{2.1}{\gram} of aspirin was obtained (\SI{75}{\percent} yield).

\subsection{Spectroscopy}
\ce{^{1}H NMR} (400 MHz, CDCl3): $\delta$ 7.25 (m, 5H), 2.35 (s, 3H).
IR: \SI{1750}{\per\centi\meter} (C=O stretch)

\section{Conclusion}
The aspirin synthesis was successful with good yield and purity.

\printbibliography
\end{document}
```

12.2 Beamer Slide Template for a Chemistry Presentation

```
\documentclass{beamer}
\usepackage[version=4]{mhchem}
\usepackage{chemfig}
\usetheme{Madrid}

\title{Electrophilic Aromatic Substitution}
\author{Nishtha Tikalal}
\date{}

\begin{document}
\frame{\titlepage}

\begin{frame}{Reaction Overview}
\ce{C6H6 + HNO3 ->[\ce{H2SO4}] C6H5NO2 + H2O}
\end{frame}

\begin{frame}{Mechanism}
\schemestart
\chemfig{*6(=-=-=)}
\arrow{->[\ce{NO2+}]}
\chemfig{*6(-=-(-NO2)-=-)}
\schemestop
\end{frame}

\end{document}
```

12.3 Thesis Chapter Template (Sectioned Chemistry Report)

```
\chapter{Synthesis of Sulfonamides via Electrophilic Aromatic Substitution}

\section{Introduction}
```

```
Sulfonamides are pharmacologically active compounds often synthesized...

\section{Reaction Scheme}
\schemestart
\chemfig{C6H5NH2}
\arrow{->[\ce{SO2Cl2}]}
\chemfig{C6H5-NH-SO2Cl}
\schemestop

\section{Experimental Procedure}
All reagents were used as received. Aminobenzene (5 mmol)...

\section{Analytical Data}
\ce{^{1}H NMR} (400 MHz): $\delta$ 6.5-7.8 ppm
MS (ESI): m/z 215 [M+H]+

\section{Conclusion}
The sulfonamide was obtained with good yield and confirmed by spectral data.
```

Try This!

- Modify the lab template to include a new reaction or reagent.
- Create a slide deck for a real synthesis reaction.
- Use the thesis chapter structure to begin your project or dissertation writing.

Lab Tip

Start each semester by creating personal copies of these templates and customizing them for each course or lab. Keep your ‘.bib‘ and ‘.sty‘ files reusable across projects.

What’s Next

In the final chapter, we share further resources — Overleaf templates, documentation, and community links to help you deepen your LaTeX fluency.

Chapter 13

Further Resources

13.1 Overleaf Templates for Chemists

Overleaf hosts a wide collection of chemistry-focused templates:

- ACS journal submission templates: `https://www.overleaf.com/latex/templates/acs-publication/jgvcpvchbjty`
- ChemRxiv preprint template
- Thesis templates by university (search for your institution)
- Poster templates using `beamerposter`

13.2 Key Packages and Their Documentation

- **mhchem** — chemical formulas and reactions `https://ctan.org/pkg/mhchem`
- **chemfig** — molecular structures and mechanisms `https://ctan.org/pkg/chemfig`
- **siunitx** — scientific units and numbers `https://ctan.org/pkg/siunitx`
- **biblatex** — bibliography management `https://ctan.org/pkg/biblatex`
- **beamer** — presentation slides `https://ctan.org/pkg/beamer`

13.3 Helpful Communities and Forums

- **TeX StackExchange**: `https://tex.stackexchange.com/questions/tagged/chemistry`

- **LaTeX Reddit**: `https://reddit.com/r/LaTeX`
- **Overleaf Learn Platform**: `https://www.overleaf.com/learn`
- **CTAN (Comprehensive TeX Archive Network)**: `https://ctan.org`

13.4 Useful Tools for Chemists

- **JabRef** — open-source BibTeX reference manager `https://www.jabref.org/`
- **BibGuru** — fast online BibTeX generator `https://www.bibguru.com/latex/`
- **PubChem** → Export citation → BibTeX format `https://pubchem.ncbi.nlm.nih.gov/`
- **Mathpix Snip** — Convert handwritten or image-based chemical expressions to LaTeX `https://mathpix.com`

13.5 License and Acknowledgments

With Thanks To:

- The Overleaf and TeX communities
- Instructors and students who inspired the math and chemistry LaTeX guides
- Open-source developers who maintain the packages this book relies on

Final Thought

> *"LaTeX isn't just about writing formulas — it's about clarity, professionalism, and sharing chemistry with the world."*