

## The IUPAC Green Book - Units Dictators Source Book?

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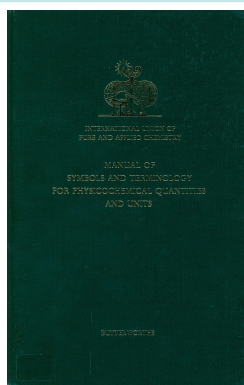
RSC Publishing

## Table of Content

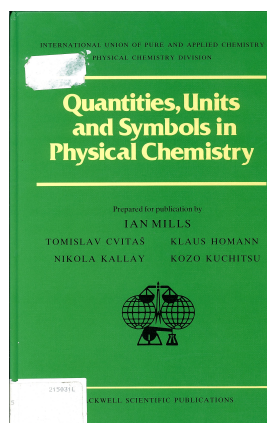
1. Some Remarks on the IUPAC Green Book
2. Relevance to Society
3. Philosophy of the IUPAC Green Book
4. Overview of Topics Found in the Green Book
5. Outlook

# 1. Some Remarks on the IUPAC Green Book

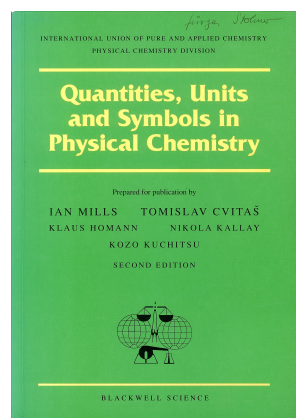
## History



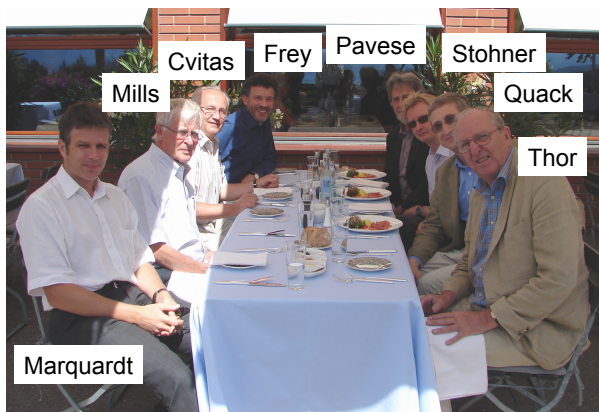
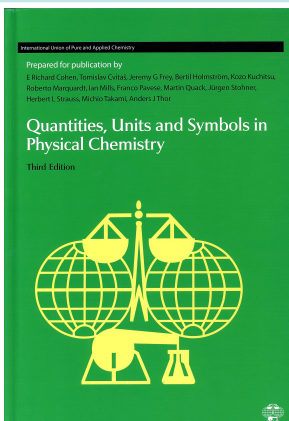
Manual  
Christiansen (1959)  
McGlashan (1970)



1<sup>st</sup> Edition (1988)  
Mills, Cvitas, Homann,  
Kallay, Kuchitsu



2<sup>nd</sup> Edition (1993)  
Mills, Cvitas, Homann,  
Kallay, Kuchitsu



3<sup>rd</sup> Edition (2007)  
Cohen, Cvitas, Frey, Holmström,  
Kuchitsu, Marquardt, Mills, Pavese,  
Quack, Stohner, Strauss, Takami, Thor

Green Book Working Party  
Zürich 2006

## Aims

- Improve the exchange of scientific information (different disciplines, different nations)
- “It is not the aim to present a list of recommendations in form of commandments.” Rather it should help the user in what may be called a ‘good practice of scientific usage’.

### BUT

- “SI” Equals System Imbecilic (APS Viewpoint, October 2001 by C. W. McCutchen)  
“...We who do and make things have let the *units dictators* force us to use the metric system...We should throw off the yoke. We should use whatever units are convenient.”

## Procedure

- Recommendations published in PAC
- Major changes based on Recommendations or extensions are included in a next printed Edition after discussion and approval of GBWP
- Minor changes are considered
  - in the next printing or
  - in form of a separate document downloadable from the IUPAC webpage
- Names of quantities, units: NOT the business of the GB (rather ISO etc.)
- Symbols must comply with IUPAC rules (approval via ICTNS)

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## 2. Relevance to Society

- Example 1: NASA Mars Climate Orbiter
- Example 2: Bridge between Germany and Switzerland (Laufenburg)
- Example 3: Toxicology

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## exploringmars in-depth specials

### Metric mishap caused loss of NASA orbiter

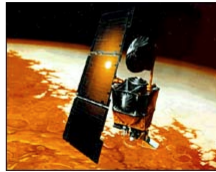
September 30, 1999  
Web posted at: 4:21 p.m. EDT (2021 GMT)

**In this story:**

[Metric system used by NASA for many years](#)

[Error points to nation's conversion lag](#)

[RELATED STORIES, SITES](#) ↓



NASA's Climate Orbiter was lost September 23, 1999

In 1999 NASA lost Mars Climate Orbiter (MCO) due to wrong conversion between metric and English units.

Loss of about 150 Mio USD on equipment.

Non-quantified loss of scientific data and work.



Construction of the Laufenburg bridge over the Rhine between Switzerland and Germany (2003).

**Reference levels:**

Germany refers to North Sea and Switzerland to the Mediterranean Sea

Difference in reference levels: 27 cm.

**Error in adjustment (wrong sign!) led finally to a total error of about 54 cm.**

C. Tomaszewski, MD  
Editorial in *J. Med. Toxicology*, September 2007:

Blood glucose level given in 42 mg/dl instead of the correct reading of 42 mmol/L (rather 758 mg/dl and rather hyperglycemia than hypoglycemia)

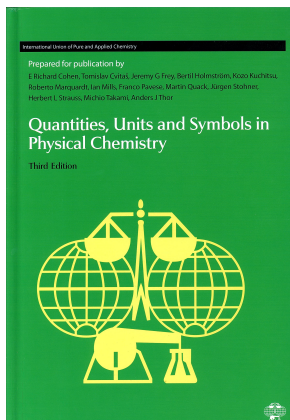
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Glucose meter made in U.S. “...one of the few hold-out countries, which includes Liberia and Myanmar, in adopting the ... metric system.”

“Even the U.K. ... has made the switch in medicine and commerce ...”

“According to the International Committee of *Medical Journal Editors*, all measurements are to be reported in metric units and temperature in degrees Celsius. ... We need to speak the same language scientifically.”

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**Third Printing of 3<sup>rd</sup> Edition 2011**  
**Fourth Printing in preparation**

1<sup>st</sup> Printing 2007  
2<sup>nd</sup> corrected Printing 2008  
3<sup>rd</sup> Printing 2011  
4<sup>th</sup> corrected Printing, 2014

<http://www.rsc.org/Publishing/Books/0854044337.asp>

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### 3. Philosophy of the Green Book

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### Preface

- “The purpose of this manual is to improve the exchange of scientific information among the readers in different disciplines and across different nations ...“
- “... each discipline has a tendency to retreat into its own jargon. This book attempts to provide a readable compilation of widely used terms and symbols from many sources together with brief understandable definitions.“
- “... but a few definitions and symbols are not universally accepted. In such cases, we have attempted to list acceptable alternatives.“

### Historical Introduction

- “... tradition of this manual. It is not the aim to present a list of recommendations in form of commandments. Rather we have always followed the principle that this manual should help the user in what may be called “good practice of scientific language”. If there are several well established uses or conventions, these have been mentioned, giving preference to one, when this is useful, but making allowance for variety, if such variety is not harmful to clarity. In a few cases possible improvements of conventions or language are mentioned with appropriate reference, even if uncommon, but without specific recommendation. In those cases where certain common uses are deprecated, there are very strong reasons for this and the reader should follow the corresponding advice.“



## Role of the Green Book

UN, UNESCO and EU have adopted the IUPAC system of nomenclature, terminology and units as their official legal position. Customs documents must apply to IUPAC standards.

This puts additional “pressure” on Commission I.1 (Green Book Working Party) and ICTNS.

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## 4. Green Book Topics

### Table of Content

1. Physical Quantities and Units
2. Tables of Physical Quantities
3. Definitions and Symbols for Units
4. Recommended Mathematical Symbols
- 5. Fundamental Physical Constants**
- 6. Properties** of Particles, Elements, and Nuclides
7. Conversion of Units
- 8. Uncertainty**
9. Abbreviations and Acronyms

About 250 pages with 50 pages **Index of Symbols** and **Subject Index**, PSE, Conversion Tables for Pressure and Energy

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## 5. Outlook

- A new version “Green Book Light” is close to final form (2014) for high-school and undergraduate students covering General Chemistry, Thermodynamics, Kinetics, Spectroscopy and Basic Physics.  
Examples of best practice in use of terminology, quantities, units and their symbols
- 4-page Summary (Brochure) *Chemistry International* **33**(4), July/August 2011
- 2014 Fourth Printing (with corrections) of 3<sup>rd</sup> Edition
- 2015 4<sup>th</sup> Edition will start

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- Definition of the seven SI base units are subject to changes as experimental methods lead to an increase in precision and accuracy.

Redefinitions:

second (counting periods of the radiation corresponding to a transition between two hyperfine levels of Cs-133)

One wishes to redefine the kilogram (along with ampere, kelvin and mole) in terms of fundamental physical constants.

T. Feder, *Phys. Today* p. 32, April 2006;  
I. Mills et al. *Metrologia* **42**, 71 (2005)

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We gratefully acknowledge

Extensive comments and suggestions by  
numerous reviewers and readers of the  
Green Book

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