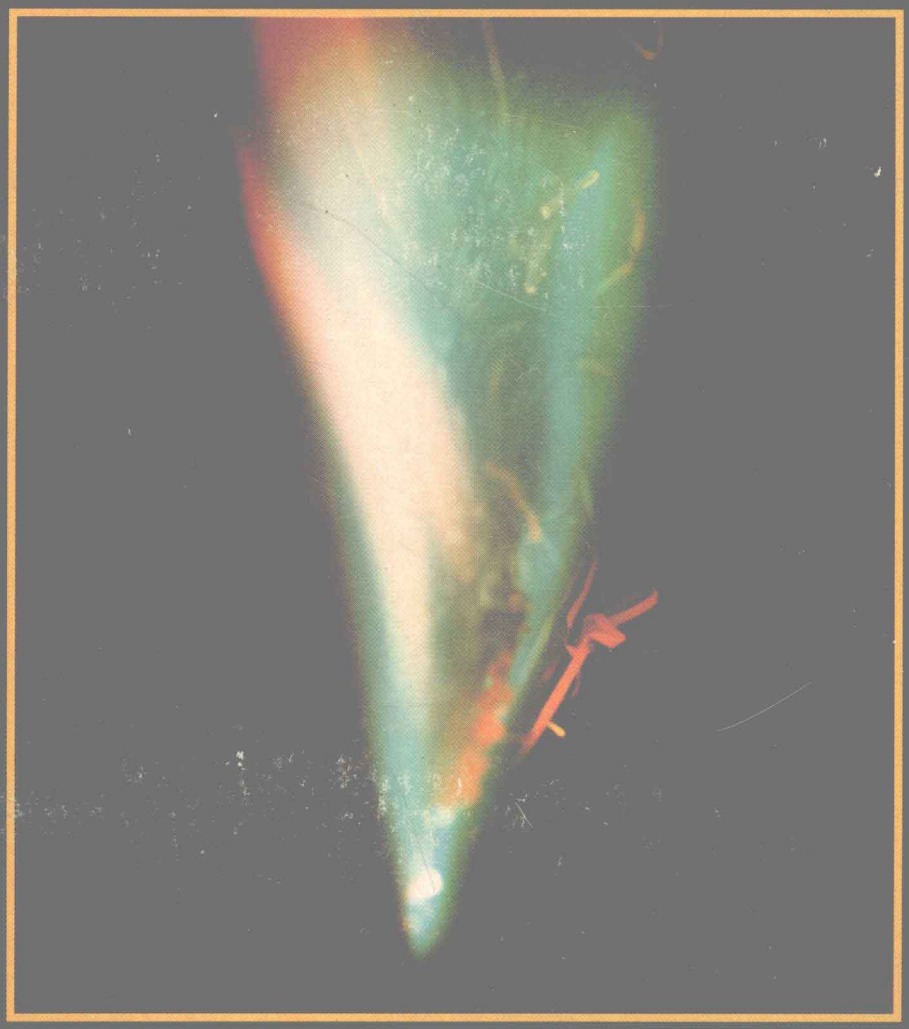
Ronald O. Ragsdale



Lecture Outline to accompany

CHEMISTRY

Principles & Reactions

SECOND EDITION

Masterton/Hurley

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CHEMISTRY

Principles & Reactions

SECOND EDITION

by William L. Masterton
and Cecile N. Hurley

Ronald O. Ragsdale
The University of Utah

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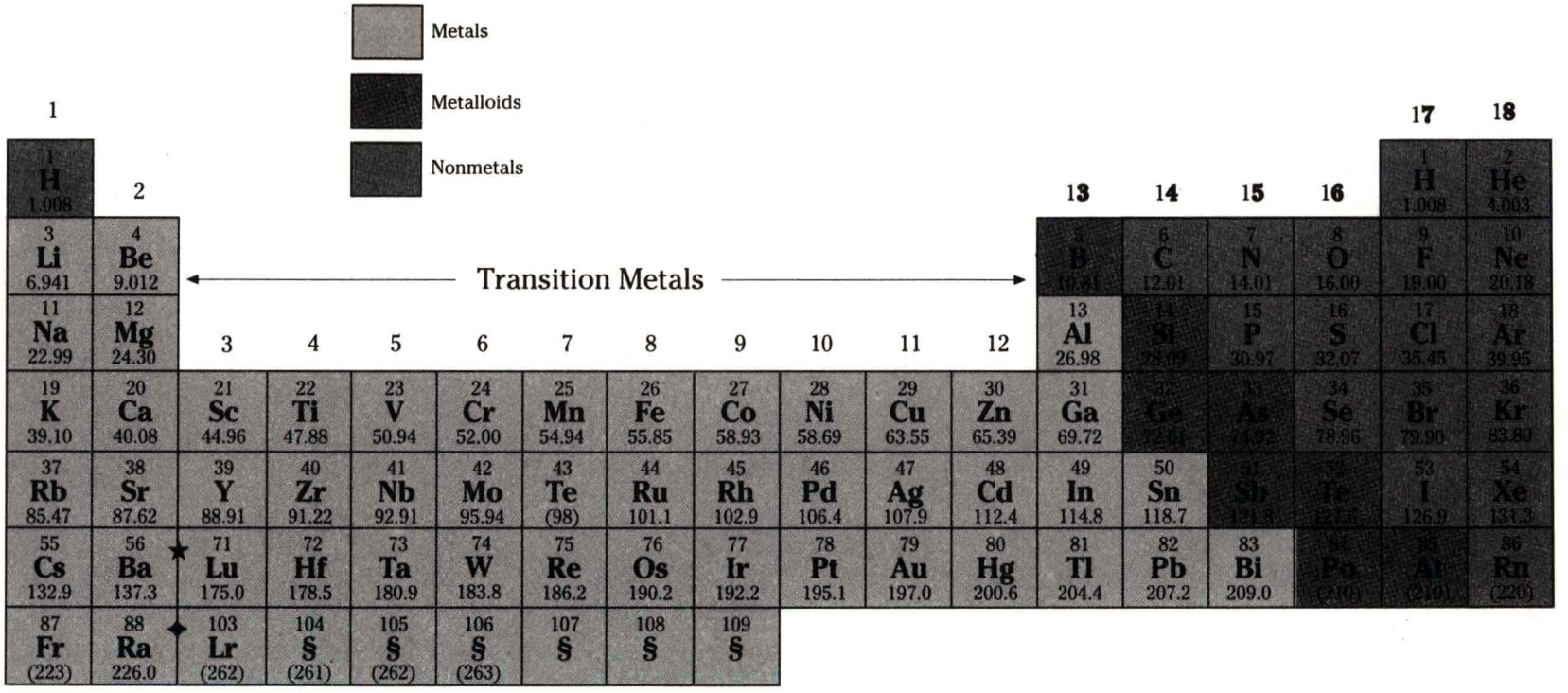
Periodic Table of the Elements



§ The International Union for Pure and Applied Chemistry has not adopted official names or symbols for these elements.

Note: Atomic masses shown here are 1989 IUPAC values.

★ Lanthanides

★ 57 La 138.9	58 Ce 140.115	59 Pr 140.1	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.2	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0

✦ Actinides

✦ 89 Ac 227.0	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (256)	102 No (259)

DEDICATION

To Brooke and Lukas

TO THE STUDENT

This outline was written to help you in your study of chemistry. It includes the important facets of a general chemistry class. It helps you to focus on the key concepts and ideas.

The outline frees you from a lot of copying and this enables you to listen more effectively. After a lecture, you can use the textbook to fill in any empty spaces in your lecture outline. You can find similar examples with the explanation of Masterton and Hurley in your textbook to supplement what your instructor has given in lecture. The outline will help facilitate your study or review for an examination.

The author welcomes your suggestions for improvements in future editions of this lecture outline.

TO THE PROFESSOR

Why should students use a lecture outline? 1. Students do not need to copy as much material in class so they can listen to more of the lecture. 2. Fewer errors will "creep" into the students' notes. 3. The lecture outline provides a means of communicating with T.A.'s and correlating the activities in multisection classes that are taught by different professors. 4. Examples in the lecture outline parallel examples in the text so a student can refer to a similar example in the textbook. The students still are required to take notes so that they are active participators in the lecture. The lecture outline helps them to take better and more meaningful notes. It helps them to know what notes they should take.

A big advantage of the lecture outline becomes obvious as the professor solves illustrative examples. Each student has a copy of the (correctly stated) example before him/her, and no valuable class time is consumed by students copying the stem of the problems. Consequently the professor can solve more problems and spend more time focusing on the important features of the problems and help the students develop problem solving skills.

There are many examples in the lecture outline, so some can be omitted. There is also space at the end of each chapter for additional notes and examples that a professor may want to give.

A professor needs to learn how to use a lecture outline. In my lectures I use transparencies and multicolors of ink. One color corresponds to the material that the student has in the lecture outline and all of this is prewritten on the transparency or transparencies are Xeroxed from the lecture outline. Some of my explanations and some of the examples will already be written in the other colors. Of course some of the lecture notes will be added in other colors during the lecture. The first time through the course, more effort is expended by the professor for a given lecture. The second time through, much less effort is required in giving a quality well organized lecture.

The most important aspect about the lecture outline is that the students really like them. They are disappointed when one gives a lecture in which they are not used.

The material in this outline is presented in the same order and with the same section numbers as the textbook. Thus, students and instructors can easily correlate the text and outline. To distinguish the lecture outline examples from the text examples, the outline examples are all designated with an "L".

The author welcomes suggestions for improvement in future editions of the lecture outline.

ACKNOWLEDGEMENT

The author greatly appreciates the efforts of Donna Keyes who typed this manuscript.

TABLE OF CONTENTS

1
Matter and Measurements

1.1 TYPES OF MATTER

What are two different categories of matter?

Elements

What is an element?

Compounds

What is a compound?

Mixtures

What are two types of mixture?

1. **A homogeneous mixture**

2. **A heterogeneous mixture**

1.2 MEASUREMENTS; QUANTITIES AND UNITS

Length

The basic unit of length in the metric system is the meter.
1 m = ···

1 nm = ···

Mass

In the metric system, mass may be expressed in ···

Temperature

Temperature is the factor that determines the direction of heat flow.

The freezing point and boiling point of water on the celsius and Fahrenheit scales are ···

The relationship between °F and °C is ···

The absolute or Kelvin scale is used extensively in chemistry. The relationship between temperatures in K and °C is ···

Example 1L.1

A baby has a temperature of 39.8°C. Is the baby ill? Express its temperature in °F and K.

Derived Quantities and Units

Volume

The SI unit for volume is ···

What are some units of volume that are used in chemistry?

Force
The SI unit of force is ···

Pressure
The SI unit for pressure is ···

The **standard atmosphere** is ···

Energy
The SI unit of energy is ···

The relationship between calories and joules is ···

1.3 UNCERTAINTIES IN MEASUREMENTS; SIGNIFICANT FIGURES

Every measurement has a degree uncertainty. How large the uncertainty depends upon ···

With each measurement the degree of uncertainty should be noted.

A method of citing the degree of confidence in a measurement is often described in terms of **significant figures**.

Counting Significant Figures

1. **All nonzero digits are significant.**

2. **Zeros between nonzero digits are significant.**

3. **Zeros beyond the decimal point at the end of a number are significant.**

4. **Zeros preceding the first nonzero digit in a number are not significant.**

Example 1L.2

Three different students weigh the same object, using different balances. They report the following masses:

a. 30.0 g b. 29.9801 g c. 0.03 kg

How many significant figures are there in each value?

Significant Figures in Multiplication and Division

When experimental quantities are multiplied or divided, the number of significant figures in the result is the same as that in the quantity with the smallest number of significant figures.

The Rules for 'Rounding Off' a Measurement

1. **If the digits to be discarded are less than -500 ···, leave the last digit unchanged.**

2. **If the digits to be discarded are greater than -500 ···, add one to the last digit.**

3. **If, perchance, the digits to be discarded are -500 ··· (or simply -5 by itself), round off so that the last digit is an even number.**

Example 1L.3

Calculate the density of copper to the proper number of significant figures for a sample of copper that weighs 50.5297 g and has a volume of 5.64 cm^3.

Uncertainties in Addition and Subtraction

Rules for addition and subtraction are different than for multiplication and division.

When experimental quantities are added or subtracted, the number of digits beyond the decimal point in the result is the same as that in the quantity with the smallest number of digits beyond the decimal point.

Example 1L.4

How many significant figures should be reported for the total mass of three objects which were weighed on three different balances?

129.0 g (weighed on a platform balance)
53.21 g (weighed on a centigram balance)
1.4365 g (weighed on a 0.1 mg balance)

Exact Numbers

What is an exact number?

Give an example of an exact number