

LECTURE III.

GENERAL CHEMISTRY AND ANALYSIS

- I. *General*
 1. General encyclopedias and dictionaries
 2. Special dictionaries
- II. *Tables of data, constants, and formulas*
- III. *Texts*
 1. Comprehensive. 2. Brief. 3. Special
- IV. *Serials*
 1. Original papers
 2. Index, review, abstract.

Under I, 1, the best now is Thorpe, Ed. 2, in 5 volumes, with fairly long accounts of processes and products and some references. The French Encyclopédie chimique, 93 volumes and a collective index, is a series of monographs by authorities, now rather old. Watt, Ure, and Muspratt, have each some historical value. Wurtz, in the second edition, is good for its date, 1874-82. Ladenburg, German, 13 volumes and index, is helpful for history. Older yet is the Liebig-Poggendorff-Wöhler, while the latter edition revised by Fehling is not here.

For I, 2, Organic, Richter's Lexikon, Ed. 3, and the Litteratur-register, supplement, is the best now, includes material through 1911.

This is a formula index, with some extra material, for Beilstein's Handbuch, the latter giving much information about specific substances.

Inorganic, has Hoffmann and Theel, incomplete as yet, on the plan of Richter, with references to Gmelin-Kraut, Ed. 7, thus: N: 4, 3, 175.

Biochemical, including both inorganic and organic, and more recent than Ed. 3 of either Beilstein or Richter is Abderhalden's Biochemisches Handlexikon, in many volumes with supplementary ones at intervals. It gives references.

II. Landolt-Börnstein, Ed. 4, is the most comprehensive, with the volumes of Tables annuelles, which add material published in 1910, '11, '12.

The volume by the Société française de physique is newer, 1913. The Castell-Evans tables are older, but have headings, etc., in English, and are more brief.

Smaller works, are the Chemiker Kalender, which has been published annually for more than 30 years; the English, Chemists' Yearbook, begun in 1917, with a 7-page list of important events in the history of chemistry; Van Nostrand's Chemical annual, new edition now is of 1918; the Handbook, Chemical Rubber Co., smaller and less costly; all these have logarithm tables.

Solubility tables are ^{by} Comey, Seidell, and Segerblom.

German language

Unusual German terms are given in more common words, in Andes, Technologisches Lexikon; Patterson, is the best for German-English chemical terms; Lang gives terms used in medicine and allied sciences.

III. *Texts*

In German, the Ed. 2 of Ostwald, incomplete, is the best here; his Handbuch, said to be partly ready, is to be a 20-volume encyclopedic affair.

Graham, in English, has been re-edited as Graham-Otto, but not revised recently.

In English, the best now is Roscoe and Schorlemmer, 2 volumes, the metals and non-metals; the organic section in English is too old.

For the **organic** only, use Meyer and Jacobson, Ed. 2 now partly complete, or Richter, **Carbon** compounds (eleventh edition is here in German, but has been translated). Cohen, Organic chemistry, in 3 volumes, 1919, is for the specialist.

The smaller one-volume general chemistries include, among newer editions and works, those by W. A. Noyes, Alexander Smith, McPherson and Henderson, Cady, and many less comprehensive ones.

Mellor on inorganic, and Alex. Smith are good and new.

IV. *Serials*

These are very many and the number increases. The principal societies all publish important Journals, some of which have already been mentioned.

Those at Chemistry, containing chiefly original papers, in order of age, are: *Annales de chimie* (formerly *et de physique*) 1789-, founded under the patronage of the French Academy by Lavoisier and associates, "to promote the science of chemistry, since, if one among the many sciences may be called the essential one, chemistry is that one". It had some abstracts to about 1870. The physics section became a separate serial in 1914. There are collective indexes, for each series of 20 to 40 volumes.

Journal für praktische chemie, 1834-, continues Scherer's *Allgemeines journal*, 1798-1833 (Bolton, *Serials*, p. 1070). It ceased publishing abstracts about 1870.

Annalen der chemie und pharmacie (Liebig's) 1832- continues two older serials, one on pharmacy. It had abstracts till 1880, has an 8-volume supplement, annual and collective indexes.

The three just named have now principally papers upon topics in organic chemistry only. *Annalen* began v. 1 with a paper on lactic acid, while practical in the modern sense is not in the *Journal*.

Journal of the Chemical society, 1841-, called first *Memoirs*, then *Quarterly journal*, has always had abstracts of great value, good annual and collective indexes.

Berichte der deutschen chemischen gesellschaft, 1867-, had abstracts till 1896; annual and two collective indexes.

Recent volumes of *Annalen*, *Journal of the Chemical society*, and *Berichte*, *Monatshefte* (Austrian), *Recueil des travaux chimiques des Pays-Bas et de la Belgique*, have formula-indexes to organic compounds mentioned in original papers in each year.

Bulletin de la société chimique de France (formerly *de Paris*) 1858-, has abstracts less comprehensive than the *Journal of the chemical society*, and both annual and collective indexes.

Journal of the American chemical society, 1879-, had some abstracts till 1891, published a *Review of American chemical research* in part 1896-1905, and the *Chemical Abstracts*, 1907-.

Less widely known are the *Gazzetta chimica italiana*, 1871-, *Monatshefte*, 1881-, no abstracts in either; the *Bulletin of the Belgian society*, 1887-, and the *Recueil*, from Leyden, 1882-, both in French, give original papers only. So too do the Dutch *Chemisch Weekblad*, and the two Swedish ones, *Arkiv för Kemi*, and *Svensk Kemisk Tidskrift*. The *Weekblad*, *Arkiv*, and *Monatshefte* were formerly the chemical sections of the proceedings of the respective Royal societies.

Chemical news, 1859-, one collective index v. 1-100, gives a few abstracts and even reprints whole papers from other serials.

Revue générale de chimie, 1899-, with its very brief abstracts in a separate volume called *Répertoire*, is mostly industrial.

Chemiker-zeitung, 1877, appears three times a week, being almost a chemical newspaper, with a fair abstract section, sometimes bound separately.

The *Journal of industrial and engineering chemistry*, 1909-, is perhaps hardly general enough in scope to be included here; *Chemical Age (American)* 1919-, is industrial.

IV, 2. *Index, review, and abstract serials*

These, called also the reference serials, are of the greatest importance, since they make it more nearly possible to keep track of what is being done by other chemists, thus saving duplication of labor.

Index serials, give reference only, i. e., author, title or topic of article, name of serial, volume, pages, date.

The *International Catalogue of scientific literature: Chemistry*, 1901-, is the chief one; like all annual serials it is published long after the material it indexes. Material is entered under both author and subject.

Review serials, give a more or less continuous narrative account of progress, somewhat critical, noting the most important papers only, and give brief references to author and place of original publication.

Berzelius' *Jahresbericht*, 1822-55, is the oldest we have; *Fortschritte der chemie*, 1904-, was first an abstract serial: *Annual Reports*, from the Chemical society (English) 1904-, is perhaps the most useful now.

Review serials generally include the work of a whole year.

Abstract serials, published at brief intervals, give a contemporary record of all work, so far as the editors are able. They give author, title (sometimes in original language), serial, volume, pages, date, and a more or less elaborate but brief summary of the contents of each article.

The three most valued for general chemistry are:

Journal of the Chemical society, Abstracts section, monthly, 1841-, collective indexes.

Chemical Abstracts, 1907-, twice a month, index v. 1-10.

Chemisches Zentralblatt, 1832-, weekly, some collective indexes, and since Jan., 1919, including industrial abstracts formerly in *Zeitschrift für angewandte chemie*.

Jahresbericht (Liebig and Kopp) 1847-, a review serial in form till about 1887, has since become "abstracts", and is very complete, but slow, as in 1914 the volume for 1911 had not been finished.

Meyer's Jahrbuch, 1891-, gives abstracts of a selected list, presumably only the most important articles.

Industrial abstracts, are to be looked for in the special serials covering that field, though many are given in the general ones above.

B. ANALYSIS: BOOKS AND SERIALS

Much material is found on this in general works, and that for special substances or fields, has a plentiful special literature. There are, however, a considerable number of books and a few serials, upon the topic of analysis, considered as a special subject.

Books

I. Methods: qualitative, quantitative, electrolytic, volumetric, spectrum.

II. Substances: inorganic, organic; applied, as biochemical, foods and drinks, other special materials.

Serials

General analysis (original papers), abstracts, etc.; on special fields.

Methods

Here the older books, due to our present improved apparatus and technique, are of use for reference on the historical side. Fresenius, often re-edited and translated, has been replaced largely by the latest version of Treadwell. Crookes, *Select methods*, and Classen, *Ausgewählte methoden*, have been revised recently. Scott, *Standard methods*, gives American practice, and Gooch, the Yale methods. Margosches, and Peters, the latter not yet received are rather "publishers' series" of monographs, than connected works. Villavecchia, translated from Italian, is quite new, 1918, with some additions by the English translator. Ostwald, *Scientific foundations*, gives the older theory, Stieglitz the newer together with many literature references.

Prescott and Johnson is relied upon largely for qualitative.

Smaller works of recent date include Julian, Morse, Böttger, Beckurts, Blasdale, and G. McP. Smith.

Electrolytic, is dealt with in Cairns, Danneel, Heumann, Elb, LöblLorenz, E. F. Smith, and others.

Volumetric almost began with Mohr's *Titirbuch*, 1855.

Sutton, for long the best in English has been out of print for five years, but the author promises a new edition some day.

Classen, *Theorie und praxis der massanalyse*, 1912, is in German only; Schimpf, a qualitative text, Ed. 3, 1917, is said to be good for volumetric with the newer revised procedures.

Spectrum analysis dates from the discovery of it by Bunsen and Kirchhoff, 1850-60. Kayser, 6 volumes in German, and Baly one volume in English, are types of the works.

II. *Substances. Divisions*

Inorganic: Stähler, to be 4 volumes, methods, not completed.

Organic: Allen, commercial; Lunge, technical, and Post, too; general methods

in Weyl, Lassar-Cohn, Hans Meyer, and Mulliken, v. 4 of last not published to date. Smaller are Sherman, Clark, Weston, Neave, Kingscott and Knight (quantitative).

Applied: Allen, Lunge, Post, and the newest, Villavecchia. Molinari, and the newer Martin give some material.

Biochemical: Abderhalden in his Arbeitsmethoden, gives much; Hoppe-Seyler-Thierfelder, one volume, older, good; Hawk, Plimmer, Hammarsten, Cole, are in English; use newest edition of all.

Food, beverages, etc.: Leach, Ed. 4 is invaluable, plus U. S. Chem. Bureau Bulletin 107, and Sherman, Organic analysis; König, Ed. 4, 4 vol., best on composition.

Other materials: Typical works are for *gas*, Dennis, Hempel, White; *oils*, Lewkowitsch, Gill, Andes; *sugar*, Brown, Lippmann; *steel*, Johnson; *paint*, Holley, Friend, Hurst, Gardner; *dyes*, Green, Fay, Wahl.

. Agriculture: Wiley, Pott.

Chemicals: Merck on tests for purity.

Serials on analysis

Material is in all the general, applied, and special serials.

Those devoted to analytical particularly are: Zeitschrift für analytische chemie, 1862-, original papers, and also many abstracts. Annual and collective indexes.

Analyst, 1877-, organ of English Society of public analysts, originals, abstracts, annual and collective indexes.

No TP *m* Much attention to adulteration of foods. *It pays*

Annales de chimie analytique et de chimie appliquée (now, et Revue de chimie analytique 1896-, added to it), 1900-, gives brief articles and abstracts, resembles Analyst: Annual indexes.

For complete literature, see general abstract serials, and also any covering particular topic, as Experiment station record, Zeitschr. f. fleisch-und milchhygiene.

SUGGESTIONS UPON LOOKING UP ALL LITERATURE OF SUBJECT

Material may be in books; for this, look in catalogue, under the specific subject, i. e. Coal, rather than Fuel. Subjects are written in red on the top line above author's name. Card is marked in margin below the call number, to show if book is at a seminar library; unmarked subject cards are for books in Main library.

Recent work must be looked up in serials, chiefly and most easily, and most speedily, through the abstract serials. Here unless the date of particular work is known, begin with the most recent collective index, as that of the Chemical Abstracts, or the Journal of the Chemical society, as being in English and most rapidly handled.

Complete the list then, usually after references have been arranged by author for convenience in checking, by use of Chemisches Zentralblatt, Jahresbericht (Liebig and Kopp), and any special indexes for the subject.

Organic chemists, looking up a special substance, knowing the formula, can use Richter's Lexikon, with supplement now for 1910-11; this gives reference to Beilstein's Handbuch, where is summarized the literature (including supplement to Ed. 3) through July, 1903. If the name only is known, (must be in German) look in the collective index for Beilstein, and then in the more recent literature by formula and name both.

The earliest abstracts to be found here are those in the *Annales de chimie*, 1789-, and in the *Jahresbericht*, (Berzelius), 1822-55.

The *Chemist* (Watt) 1840-58, published some abstracts and some fairly long translations from foreign sources.

The material given by the review serial forms an abstract of the article, but is usually much more brief than that in serials designated as "abstract", since the "review" serial pays little attention to the individual articles.

REFERENCE SERIALS FOR USE IN PROBLEMS

The list given below shows what periods of time and topics are covered by the more general abstract and review serials:

- I. General chemistry, author or subject known, after 1841, before 1917,
 - A. Collective indexes, in this order
 - Chemical Abstracts v. 1-10
 - Journal of the Chemical society, 1903-12, etc.,
 - Jahresbericht (Liebig and Kopp)
 - Chemisches Zentralblatt
 - B. After 1916, annual indexes for above, and current numbers.
 - C. Before 1841, Collective indexes of
 - Annales de chimie*, 1789-, *Jahresbericht* (Berzelius) 1822-55.
- II. Inorganic chemistry
 - In addition to those in I, collective, and later annual indexes
 - Journal of society of chemical industry, 1882-
 - Zeitschrift für anorganische chemie*, 1892-
- III. Organic chemistry
 - A. Substance by formula, to Nov., 1909, Richter's Lexikon 1910-11, Litteratur-register 1912 date, annual formula indexes of
 - Journal of chemical society, *Annalen*, *Berichte*, *Recueil*, *Monatshefte*; these are for original papers in these serials only.
 - B. Substances by name, through July, 1903, in collective index of Beilstein; 1903 on, as in I, A and B.
 - C. Theory, methods, etc., as in I, A, B, C.
- IV. Biochemistry
 - Before 1870, as in I, C.
 - After 1870, *Jahresbericht* (Maly), with ten-year indexes and annual index of recent volumes.
 - 1902 on, *Biöchemisches zentralblatt*, now *Zentralblatt für biochemie und biophysik*;
 - 1916 on, *Physiological abstracts*

Index Medicus, 1879-, and indexes (collective) of special serials, as Biochem. zeit., 1906-, Zeit. f. physiol. chem., 1877-.

Use Abderhalden, Biochemisches handlexikon, also.

V. Applied chemistry

A. Before 1855, as in I, A and C.

B. After 1855, Jahresbericht (Wagner) collective indexes

C. After 1882, use also Journal of society of chemical industry, collective and annual indexes.

D. From 1887, to 1918 inclusive, Zeitschrift für angewandte chemie, (1919 on, in Chem. Zentr.)

E. Check later work as in I, A, B.

Use also, special serials with indexes, for special fields in applied chemistry.

For topics leaning toward engineering, look up also in the Engineering index, 1884 date.

Popular articles, are found through Poole's Index to magazines continued by various indexes, as Cumulative Index, 1896-1903, and Readers' guide, 1903 date.

Selected scientific serials are indexed by the Industrial Arts Index, 1913 to date.

Author indexes for each number, are in Chem. Abstracts, Chem. Zentralblatt, Journal of the Chemical society.

LECTURE IV.

INORGANIC AND MINERAL CHEMISTRY: BOOKS

- | | | | |
|-----------------------|--------------------|-------------------|-----------------|
| A. General | 1. Comprehensive | 2. Brief | 3. Dictionaries |
| B. Special | 1. Methods | 2. Preparations | |
| C. Related topics | 1. Metallurgy | 2. Metallography | 3. Assaying |
| D. Special substances | 1. Precious metals | 2. Iron and steel | |
| | 3. Other metals | 4. Alloys | |

Perhaps the oldest section of chemistry, it has seemed for a time overshadowed by organic. Recent developments in alloys and metallography, and structure of inorganic substances have given it renewed importance.

A, 1. Best here now in English, is that of Roscoe and Schorlemmer, in two volumes, 4th and 5th edition. Mellor, much smaller, is the best of its size; latest revision of Alex. Smith is not so comprehensive as Mellor.

Friend began editing in 1914, a Textbook of inorganic chemistry, to be 9 volumes, some in several parts; only vol. 1 has come to date (1919).

Moissan's five-volume work in French resembles an elaborated Roscoe and Schorlemmer and is older now.

In German, the newest are Abegg, and Gmelin-Kraut, the latter in 7th edition. Neither of these are completed; both give many references to literature,

and the one in Abegg is dated, being put at the close of the chapter on the element, while references in Gmelin-Kraut are mixed in the text.

Abegg has index in each bound piece, while Gmelin-Kraut has index for *complete* volume only. Abegg groups elements by periodic table.

A, 2. Erdmann, Ed. 2, 1900, is fair, but Holleman Ed. 4 in English is more up to date. Blount, Ed. 10, replaces the older Bloxam and Blount. Latest edition of Newth is old. Ostwald and Ramsay are both rather old.

Werner's work on structure of inorganic compounds is important. Stewart, Recent advances is good for reference.

A, 3. Dictionaries: Ladenburg is excellent for history and early work, but Thorpe, Ed. 2, is more useful generally.

Hoffmann and Théel, on a plan which is a mixture of Beilstein, and Richter (Lexikon), has only v. 2 complete here; it refers constantly to Gmelin-Kraut, Ed. 7, by this: N: 5, 2, 871, meaning the volume, part, and page.

B, 1. Stähler's Handbuch, incomplete, is the only elaborate work.

B, 2. Largest and most recent is the inorganic volume of Vanino, 1914, which brings up to date the information in the scattered papers for a large number of substances. Its predecessor, the inorganic volume of Bender and Erdmann, was published in 1893. Erdmann has also an Introductory course, which has been translated; Blanchard is a small work, in English, also Lengfeld; F. H. Thorp's book, 1896, is perhaps used most in American laboratories.

C, 1. Hofman's General metallurgy, 1913 is fairly new; Fulton's Principles is about the same; Austin is older, and Schnabel in 2 vol., translation, is a type of the older book.

C, 2. Metallography, dealing with relation between chemical and physical properties and study of internal structure, has a number of fairly new books; translations are to be had of Goerens, 1908, Ruer, 1910, small both; Guertler, begun in 1909, is in German, incomplete as yet; Robin, 1916, in French, less in size seems good; Rosenhain, Physical metallurgy, 1915, has much of value. Desch is reliable too, but does not try to cover the whole field.

Osmond's microscopical analysis of metals belongs here.

C, 3. Assaying: Rhead is a type of the older book; newer ones are Fulton, Fire assaying, 1911; Lord, and White, are on metallurgical analysis, 1913, and 1915 respectively.

D, 1, 2, 3. See the catalogue under special subject or metal. Hofman, and Peters, for copper; Sauveur, and Bradley-Stoughton, on iron and steel with Johnson for analysis (Blair is almost too old); Ingalls, Betts, on lead, Richards on aluminium, are typical.

D, 4. Alloys: Waterbury book of alloys, pays much attention to manufacturing; other recent works are Buchanan, Practical alloying, Giua, Chemical combination among metals, 1918; Brannt, Ed. 3, 1908, Desch, Hiorns, Laws, are older. Analysis of non-ferrous alloys, is in Price and Meade (American), Ibbetson and Aitchison (English).