This is also the official organ of the sections at Lund and Upsala, as well as for the industrial society.

K. Svenska Vetenskapsakademien

Arkiv för kemi, mineralogi och geologi, 1903; this had previously appeared as the chemical section of the publication of the Swedish Academy of Sciences; articles may be in either Swedish or German, and chemistry has had the most space so far.

Switzerland

Société suisse de chimie

Helvetica chimica acta, 1918

Articles are published in French or German

United States

American Chemical Society, 1876

Journal of the American Chemical Society, 1876; volume 1, 1876-78 was called Proceedings.

This absorbed, January, 1914 on, the American Chemical Journal, 1879-1913.

Chemical Abstracts, 1907

Journal of Industrial and Engineering Chemistry, 1909.

LECTURE 3

GENERAL CHEMISTRY: BOOKS AND SERIALS

The books and serials upon general chemistry may be grouped as follows:

I. General
   1. General cyclopedias and dictionaries
   2. Special cyclopedias and dictionaries
   3. Dictionaries of languages

II. Tables of data, constants and formulas
   1. Large
   2. Small

III. Texts
   1. Comprehensive
   2. Brief
   3. Special

IV. Serials
   1. Those containing chiefly original papers
   2. Reference serials, i. e. giving indexes, reviews or abstracts

I, 1. *General cyclopedias and dictionaries*

The best now is Thorpe, Dictionary of applied chemistry, in the third edition, 1921, to be complete in six volumes; it contains fairly long accounts of the processes and products with some references. The Condensed Chemical Dictionary, 1919, while prepared for the manufacturer and dealer, is a good work of

reference where not much detailed information is needed. The French Encycl pédie chimique, 93 volumes and a collective index, a series of monographs b authorities, is now rather old, being finished in 1899. Watt, Ure, and Muspra in the various editions are valuable historically; Ladenburg, Handwörterbuch d Chemie, 1882-96, 13 volumes and index is better for history, being more elaborat Wurtz, Edition 2, 1874-82 is helpful at times; so is the much older work of Liebig Poggendorf-Wöhler; the newer edition of the latter, revised by Fehling, is n here.

I, 2. *Special cyclopedias and dictionaries*

The organic has Beilstein, Handbuch; Richter's Lexikon, and the supple ments furnish a formula index to Beilstein. The Lexikon (inorganic) by Hoff mann is incomplete as yet; it is on the plan of Richter, but gives more material it refers to Gmelin-Kraut, Handbuch der anorganischen Chemie, Edition 7, thus N: 4, 3, 175, i. e., volume 4, part 3. page 175. Abderhalden's Biochemische Handlexikon contains material upon both organic and inorganic chemistry; i is more recent than the third editions of Beilstein and Richter, and gives man references to the literature.

I, 3. *Dictionaries of languages*

The chemist will in most cases have to read French or German; the be special dictionaries are the ones compiled by A. M. Patterson, one for eac language. Lang, German-English dictionary of medical terms, gives those use in medicine and the allied sciences, useful to the student of biochemistry. Ande Technologisches Lexikon, translates unusual German terms into more ordinar words. For general German, Muret-Sanders, Encyclopedic Dictionary, abridge edition, German-English, Ed. 2, 1908, is perhaps the best one-volume work; th larger edition contains many unusual local and technical terms.

II, 1. *Tables of data, large*

Landolt-Börnstein, Physikalisch-chemische Tabellen, in Ed. 4, is perhaps th largest. The volume, Recueil, 1913, published by the Société française de physiqu contains newer data. Both are supplemented by the Annual Tables, giving mate ial newly published; vol. 1-3, covering 1910-12, appeared before the war, wi the title in French, Tables annuelles; vol. 4 has data for 1913-16, and will appe this summer; vol. 5, with data for 1917-1920 is announced for early in 1922. Th only comparable book in English is the two-volume Physico-chemical tables, 190 by John Castell Evans, a much briefer work, and no longer up to date.

II, 2. *Tables of data, small*

The oldest is the Chemiker-Kalender, published annually for over thir years; The Chemists' Yearbook, begun in 1917, is on the same plan in two sma volumes; Van Nostrand's Chemical Annual, one volume, is reëdited at varying intervals. The Chemical Rubber company puts out a Handbook, less in size and price. There are several chemists' and metallurgists' handbooks of similar char acter, as Cremer's, but they are not in this library. Tables giving solubilities are the elementary work by Segerblom, Seidell that includes organic compounds, and the new Comey and Hahn, Ed. 2. 1921, inorganic only.

I, 1. *Texts, comprehensive*

The comprehensive texts are not many. Graham's work has been reëdited rom the German version, but is too old. Ostwald's Lehrbuch der allgemeinen hemie, Ed. 2, is incomplete here; his Handbuch, to be 20 volumes of an ency opedic nature, was interrupted by the war. In English the best for the various ements has been Roscoe and Schorlemmer's Treatise on chemistry, i. e. the two norganic volumes covering the non-metals and the metals, in the most recent dition; the latest edition of the organic part here in English is about forty ears old. The new English work being published under the editorship of J. N. riend, is called a Textbook of inorganic chemistry; it goes into detail more than oscoe and Schorlemmer but is not done. Mellor's new work, Higher inorganic nd theoretical chemistry, to be six volumes should be better than Roscoe and chorlemmer. The Textbook of inorganic chemistry by Partington, 1920, is early as good for a general chemistry, giving new material and many references.

II, 2. *Texts, brief*

Types of the briefer works are:

Wm. McPherson and Wm. E. Henderson, A course in general chemistry, 1915;
W. A. Noyes, Textbook of chemistry, 1916;
Louis Kahlenburg, Outlines of chemistry, revised, 1916;
H. P. Cady, General chemistry, 1916;
Alexander Smith, General chemistry for colleges, Ed. 2, 1917;
H. N. Holmes, General chemistry, 1921.

These are intended for college textbooks: Bailey's (English) Tutorial chemstry in two volumes, Ed. 4, 1918, seems to correspond nearly to the American nes; there are similar small French and German works though not here. The erman volume, Chemie, by E. von Meyer, 1913, is more nearly historical. Texts n English of a type suited to secondary schools are numerous, but not here.

II, 3. *Texts, special*

Special works here may be, (a) for students in a particular field, or (b), eneral for a division of chemistry. Under (a) are Hale's Practical chemistry or engineering students, 1912; Kahlenberg and Hart, Chemistry in its relations o daily life, for students of agriculture and home economics in secondary schools, 1916; Elementary household chemistry, an introductory textbook for students of home economics, by J. F. Snell, 1916.

In particular fields, Meyer and Jacobson, in German, Ed. 2 is the most omplete for organic; Richter, Chemistry of the carbon compounds, Ed. 11, gives less theory; Cohen's Organic chemistry in three volumes, Ed. 2, 1919, is for the specialist; Ed. 3 is 1921. Mellor, 1918, and Partington, 1920, are recent good English texts for general inorganic works in one volume, while Norris, Textbook f inorganic chemistry, 1921, is the newest American work.

The literature of any live science is largely in the current volumes of seria The principal societies all publish proceedings, with original papers, usua calling the combination, Journal. Most of these have been mentioned in Lectu 2. The general serials, both society publications and others, at Chemistry w be considered, in order of age; these contain chiefly, original papers; whe abstracts are also given these will be noted.

IV, 1. *Serials*

Annales de chimie (formerly till 1913, et de physique), was founded in 17 by Lavoisier and his associates under the patronage of the French Academy, "c promote the science of chemistry, since, if one among the many sciences may b called the essential one, chemistry is that one". It had abstracts till about 187 The physics section became a separate serial in 1914. There are collective index for each series of twenty to forty volumes.

Annalen der Chemie (und Pharmacie), called Liebig's Annalen, was start in 1832 as Annalen der Pharmacie, and the name has varied at intervals. It h abstracts till 1860, has an 8-volume supplement, has annual and collective indexe

Journal für praktische Chemie was started in 1834 under this title, bein the combination of two others, the one Scherer's Allgemeines Journal havi existed under various titles from 1798; the Journal had abstracts till about 187 has one collective index, and annual ones. The Annales, Annalen, and Jourr have now principally papers upon organic topics; the Annalen began its fi volume with a paper upon lactic acid, while applied chemistry has no place no in the Journal.

The Journal of the Chemical Society, though the first three volumes a termed Memoirs, may be said to date from 1841; from 1849 to 1862 the title w Quarterly Journal. The Journal has always had abstracts of great value, wit good annual and collective indexes.

Two serials in English of less importance deserve mention since they gi abstracts for this early period, The Chemist, 1840-58, London, edited by Charl and John Watt, and The Chemical Gazette, 1843-59, London, edited by Willia Francis and Henry Croft; the Gazette was merged into the Chemical New founded by Crookes in 1859, to publish scientific processes and discoveries; t weekly paper is the first chemical newspaper, and following up its original pl has abstracts but presents also reprints of whole papers when the importance the subject is great. Beginning July, 1921, a special section of book revie is in the first number of each month. It has annual indexes, and a collecti index for the first hundred volumes.

The Bulletin de la Société chimique de France (formerly, de Paris) w started in 1858, and absorbed the two Répertoires that were edited by Wurtz a Barreswil and commenced in the same year. It has abstracts less comprehe sive than those of the Journal of the Chemical Society, and both annual a collective indexes.

The Deutsche chemische Gesellschaft publishes its Berichte, 1867 on; had abstracts to 1896, when they were transferred to the Chemisches Zentralblat There are annual and collective indexes, with formula indexes, after the mann of Richter's Lexikon for the original papers for recent years.

The Chemiker-Zeitung, 1877-date, published three times a week, has always
l some abstracts, forming at times a separate volume. It is for the manufac-
er particularly, but is a serial of general chemistry.

The American Chemical Society's Journal began in 1879, had some abstracts
1891, published a Review of American Chemical Research, 1896-1905; since
07, when the Society began the publication of Chemical Abstracts, the Journal
s had only original papers, book reviews and proceedings of the Society. It
sorbed the American Chemical Journal in 1913.

Several others, less widely read are: Gazzetta chimica italiana, 1871 to
te; Monatshefte (Austria), 1881 on; Bulletin of the Belgian society, 1887-,
d the Recueil from Leyden, 1882-, all four giving only original papers; so too
these: Chemisch Weekblad, Arkiv för Kemi, Svensk kemisk Tidskrift. The
eekblad, Monatshefte, and Arkiv were formerly the chemical sections of the
oceedings of the various Royal societies. The Revue générale de chimie, 1899-,
th its very brief abstracts in a separate volume as Répertoire, is largely indus-
ial and seems to have died since the war.

The Journal of Industrial and Engineering Chemistry, 1909-, is perhaps
o nearly applied chemistry, and this holds for the Chemical Age (New York),
hich continues the old Chemical Engineer; the Chemical Age is for the business
an who has chemical investments rather than for the scientist. The Sammlung
emischer und chemisch-technischer Vorträge, 1896-, edited by F. B. Ahrens is
mixture of monographs on general and technical chemical topics; a collective
ndex here in manuscript includes vol. 1-20.

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

These, called sometimes, the reference serials, are of the greatest importance,
nce they make it more nearly possible to know something of what other workers
e doing, and thus prevent duplication. They fall into three groups, according
contents and arrangement

Index serials give the reference only, i. e., name of author, title of paper in
e language of the original, name of serial, volume, pages, and date of publica-
n. For books, which are included by some index serials, author, title, date,
d place of publication are usually given. The principal index serial for chem-
istry is the Chemistry section of the International Catalogue of Scientific Liter-
ature; this began in 1902 with the literature of 1901, and each annual volume
contains approximately one year's publications. There are both author and
subject entries, the latter being brief, while full details are found under the
author entry. The scheme of classification by subjects is given at the front of
each volume, and the period covered by the volume is stated.

Review serials present a more or less critical, connected account of the prog-
ress for the year, noting the more important papers, and have only brief refer-
ences to author and place of original publication. Berzelius' Jahresbericht,
1822-49, is the oldest we have here of this type. This was published in Swedish,
while we have the German translation; volumes for the years 1841-46 were also
published in French as Rapport annuel sur les progrès des sciences physiques et
chimiques. The Fortschritte der Chimie, 1904-, was an abstract serial, called
Physikalisch-chemisches Centralblatt, to 1909, when it took the present name and

form. The Annual Reports of the Progress of Chemistry, 1904-, by the Engli Chemical Society, is perhaps the most useful to the chemist now, in the field pure science. Comparable, in German, is the Jahrbuch der Chemie (Meye 1891-, that also takes up only the more important articles. The review serials general cover periods of one year and have annual indexes, sometimes collecti ones too.

Abstract serials are published frequently, and provide a contemporaneou record of all the chemical work being done, so far as the editors are able to colle it. They give author, title (usually in the language of the abstract serial), seria volume, pages, and date; the abstractor may or may not sign his work; his ai is to give a concise but fairly complete summary of the contents of each articl The three at present of most value for general chemistry are:

1. Chemisches Zentralblatt, 1832-, published weekly, indexes for annual vo umes to 1888, to semi-annual volumes 1889-1918 inclusive; in January, 191 it took over the technical abstracts formerly done by the Zeitschrift fi angewandte Chemie, and now has four volumes a year. Collective index have been made for 1870-81, and the period, 1896-1911.
2. The Abstract sections, two in each month but appearing only at monthly in tervals, of the Journal of the Chemical Society, London. Annual index for the time since 1841, the date of the first volume of Memoirs (predecesso of the Journal), are available, with collective indexes, that now include 191 These abstracts are sometimes the best to be had, being of fair length an usually they appear very soon after the original papers.
3. Chemical Abstracts, 1907-, appears twice a month, has annual indexes and decennial (collective) index for 1907-16 inclusive. The volume for 192 has a formula index, including organic and inorganic compounds, after th manner of Richter's Lexikon; such indexes, for their own original paper only, are also in these: Journal of the Chemical Society, Annales, Annale Berichte, Journal für praktische Chemie, Monatschefte, and Recueil d travaux des Pays-Bas, for recent years, and these provided a supplement t the volumes of the Literatur-Register for looking up organic compounds.

The abstracts in the French Bulletin, dating as they do from 1858, cover t field somewhat less completely than those of the Journal of the Chemical Societ , but are sometimes of great assistance for papers appearing on the continent, and in particular for those in some of the less widely known French serials. There are annual indexes, and several collective ones, the latter including 1858-1906 at present.

The Jahresbericht (Liebig and Kopp) 1847-, started as a review serial, and kept this form in part until 1893, when it began to give titles of articles. It has good annual and collective indexes, with for the later years, formula indexes of organic compounds; however, the volumes for 1910 are the most recent we have, so that the Literatur-Register is newer. Meyer's Jahrbuch, 1891-, gives abstracts of the selected articles that seem to the editors of the greatest importance; it has annual indexes and one collective one.

The reference serials listed above are the most important for general chemistry, though they contain much on special fields, as organic, physical, biochem

al and applied topics; more and longer abstracts for these are to be found in the pecial serials.

LECTURE 4

Literature upon Analysis and Apparatus

This material is in two groups, first, the books and serials upon analysis in general, special methods, and substances, and second, that upon the apparatus and equipment of laboratories used for the purpose of teaching and research; the fitting up of plants for large-scale production belongs to the industrial or applied chemistry section.

A. Analysis: books and serials.
   I. Books on methods
   II. Books on analysis of special substances
   III. Serials

A. I. *Books on methods*

These books include those on qualitative, quantitative, volumetric, electrolytic, and spectrum analysis; colorimetic may be either qualitative or quantitative. The older works, due to the many improvements in apparatus and technique, are of use for reference and as history. Fresenius, often re-edited and translated has been replaced largely by the newest version of Treadwell, but Ed. 17, 1921, is edited by C. A. Mitchell. Prescott and Johnson in its latest revision is useful for qualitative work. The older presentation of general theory in Ostwald is supplementad by the theoretical volume of Stieglitz on qualitative. Classen, Ausgewählte Methoden, and Crookes, Select methods have been revised; newer are Scott, Standard methods, 1917, giving American practice, and Gooch's book on methods in use at Yale. A. A. Noyes, on qualitative analysis, Ed. 8, rev. is 1920.

The German works in many volumes, edited by Margosches and Peters respectively are rather "publisher's series" of monographs, and the Peters series has not been received here as yet. Villavecchia's Treatise on applied analytic chemistry, translated from the Italian in two volumes, 1918, has considerable general material in the first volume. Gardiner's Chemical analysis, qualitative and quantitative, 1914, London, is a textbook of nearly 500 pages.

Mellor's Treatise on quantitative inorganic analysis, 1913, is specially for ceramists; it is excellent, with many references to the literature. Low, Technical methods of ore analysis, Ed. 8, revised, 1919, is good and new, perhaps the best one in this field. The bulletin of the U. S. Geological Survey by Hillebrand, Analysis of silicate and carbonate rocks (formerly Bulletin 305, and then 422) is now revised and appears as Bulletin 700, 1919.

Smaller works include Julian, Morse, Talbot, Böttger, Beckurts; those of Blasdale, and G. McP. Smith are more recent. Volumetric analysis practically began with Mohr's Titrirbuch, 1855; even the tenth edition of Sutton on volumetric has long been out of print; the small text on qualitative by Schimpf, Ed. 3,

1917, is said to be excellent for volumetric, with new methods. Classen, Theorie und Praxis der Massanalyse, 1912, is here in German only.

For electrolytic analysis there are in English, Cairns, Classen, Danneel, and the newest one, E. F. Smith's Electroanalysis, Ed. 6, 1918; the work of Löb on electrochemistry of organic compounds, translated by Lorenz, is dated 1906 Spectrum analysis, discovered by Bunsen and Kirchhoff, 1850-60, is considered in one volume in English by Baly, while Kayser with six volumes in German, is an example of a more comprehensive book.

A. II. *Books on analysis of special substances*

Books upon special sections of chemistry, or special substances are numerous. Stähler in his work upon methods for inorganic chemistry, German, to be four volumes, not completed, gives many suggestions. For the organic industrial, the fourth edition of Allen is helpful, with its ninth supplementary volume giving a collective index. Lunge, with three volumes in six on technical work, and Post, Ed. 3, two volumes (this is in German only) provide methods for both organic and inorganic. Lassar-Cohn's Arbeitsmethoden, Ed. 2, Hans Meyer's Analyse, 1903, are upon organic substances only; so is Mulliken, Identification of pure organic compounds; there are to be four volumes, but the fourth is not out yet; the new edition of Weyl on organic methods is to be four volumes, nearly a dictionary in size, edited by J. Houben, volume 1 being published in 1921. Rosenthaler on organic analysis, 1914, is published as vol. 19-20 of Margosches, Die chemische Analyse.

Smaller works upon organic analysis are by Kamm, (1922), Sherman, Ed. 2, Clarke, Weston, Ed. 2, (also in French) Neave, Kingscott and Knight (this last is quantitative organic), and the two volumes by Vaubel in German on quantitative organic analysis; this last is rather old, 1902.

Applied chemistry:

Allen, Lunge (newer), Post (in German only), are general with the two-volume Villavecchia the more recent. Some material upon analysis is given in the works on industrial chemistry by Molinari, and by Martin, for both organic and inorganic. Griffin, Technical methods, 1921 is American.

Biochemical:

Abderhalden in his Arbeitsmethoden gives much; the new 1920 edition is to be 13 volumes; the older single volume of Hoppe-Seyler-Thierfelder is good; Hawk, Plimmer, Hammarsten, Cole, are in English; use the newest edition of these.

Food, beverages, etc.:

Leach, Ed. 4, is invaluable, and with this is the volume on methods by the Association of Official Agricultural Chemists, 1921; the latter is planned to replace U. S. Chemistry Bureau Bulletin 107. Sherman, Organic analysis is good here; the encyclopedia on composition of food materials is König, Chemie der menschlichen Nahrungs-und Genussmittel, Ed. 4, in 4 volumes and supplement, the methods being in vol. 3 and 4.

ther materials:

Typical works for *gas,* Dennis, Hempel, Parr, White; *oils,* Lewkowitsch, ill, Andes; *sugar,* Brown, Lippmann; *steel,* Johnson; *paint,* Friend, Hurst, ardner; *dyes,* Fay, Green, Wahl; *agriculture,* Wiley, Pott, Ingle, Ed. 3; *chem-als,* Krauch, Merck, Murray, the last an American work of 1920.

. III. *Serials on analysis*

Material upon the topic is found in all general and special serials; there are ree however upon analysis particularly; all three have always given abstracts s well as original papers, and all have collective indexes.

The oldest is the Zeitschrift für analytische Chemie, founded by R. Fresenius nd called sometimes Fresenius' Zeitschrift; it was begun in 1862. Second in time the Analyst, organ of the English Society of Public Analysts, dating from 1877; his has special interest for food and drug analysts. The newest is the French nnales de chimie analytique et de chimie appliquée, 1896, which has absorbed arious other serials of like character; both originals and abstracts in this are ery short. The Annales des falsifications (now, et des fraudes) was begun in 908, as an international bulletin to aid in preventing adulterations of food and rugs; it has always given both original papers and abstracts; it is now pub-shed by the Société des experts-chimistes de France.

A similar publication is the Répertoire international des travaux publiés sur composition, l'analyse et les falsifications des denrées alimentaires, 1901—, of hich the first two volumes were published in Dutch, the remainder in French; his has no original papers, and the abstracts are extremely brief, or even lack-ng i. e., this is almost an index serial. The volume for 1910 is the newest here, nd this is the only "abstracts only" serial for analysis. Usually, abstracts must e looked up in the serials for chemistry in general, or in those for applied hemistry, with special care to include serials upon the topic being investigated, s Experiment Station Record, for agricultural chemistry.

B. APPARATUS AND EQUIPMENT

Here we may consider books upon the testing of reagents and the prepara-on and care of apparatus. For the first class the older work of Krauch, the ook by Merck which is an amplification of Krauch, and the new Standards and sts for chemicals and reagents by Murray, 1920, will be sufficient in most cases. ests and reagents, Ed. 1, 1916, by A. I. Cohn lists the tests, etc., that are known y their authors' names. Prideaux, Theory and use of indicators, 1917, is more horough than the older small work by Cohn.

Physical methods in the chemical laboratory are dealt with in volume 1 of tähler's Handbuch, 1913, in German; apparatus is described here too. Ost-vald-Luther, Physiko-chemische Messungen, Ed. 3, 1910, is very useful; it may e supplemented by a number of the bulletins and circulars of the U. S. Bureau f Standards.

Glassblowing is a science not to be quickly learned; some books that may elp the amateur are the following:

1898, Threlfall, On laboratory arts;

1902, Hovestadt, Jena glass and its scientific and industrial applications;

1904, Ebert, Anleitung zum Glasblasen, Ed. 3;

1910, Shenstone, Methods of glass blowing (ed. 3 was 1907);

1910, Holbaum, Zeitgemässe, Herstellung, Bearbeitung und Verzierung d feineren Hohlglases;

1911, Diakonov und Lermantov, Die Bearbeitung des Glases auf dem Blas tisch. Ed. 2;

1914, Frary, Laboratory manual of glass blowing;

1920, Vigreux, Le soufflage du verre dans les laboratories scientfiques industriels. Ed. 2.

1921, Bolas, Handbook of laboratory glass blowing.

Bulletin 107 of the U. S. Bureau of Standards reports tests of chemical glas ware, and considerable material may be found in the chemical serials, 1914 to dat

Two periodicals on apparatus in German are the Zeitschrift für Instrumen kunde, and Chemische Apparatur; the latter is here and seems to pay mc attention to equipment of large size.

Prices of chemicals and supplies may be had from the various dealer catalogs, and these may be checked by the weekly price quotations for chemica in the Drug and Chemical Markets, or the similar lists in the Oil, Paint and Dru Reporter. The manner and amount of material needed to fit up a small labor tory will differ with the purpose for which it is planned; the dealers have list copious enough, for ordinary student equipment, and are ready to furnish then the specialist will know what extra pieces his work requires. Nagel, Mechanic appliances of the chemical and metallurgical industries, Ed. 2, 1909, and h Lay-out, design and construction of chemical and metallurgical plants, 191 are for the engineer rather than the chemist, besides being now old. Dyso Manual of chemical plant, is descriptive of progress in the devising of apparatu on the large scale.

LECTURE 5

INORGANIC AND MINERAL CHEMISTRY: BOOKS

This, the oldest section of chemistry, has in recent times seemed almo overshadowed in importance by the developments in the organic section; rece work upon theoretical inorganic, structure and other phases, with alloys ai metallography, has brought the inorganic side into prominence. The bool here include those on the elements, inorganic proper, and those on the minera and metals, the manufactured products.

A. *General works*
   1. Comprehensive
   2. Brief
   3. Dictionaries

B. *Special works*
   1. Methods
   2. Preparations
   3. Analysis