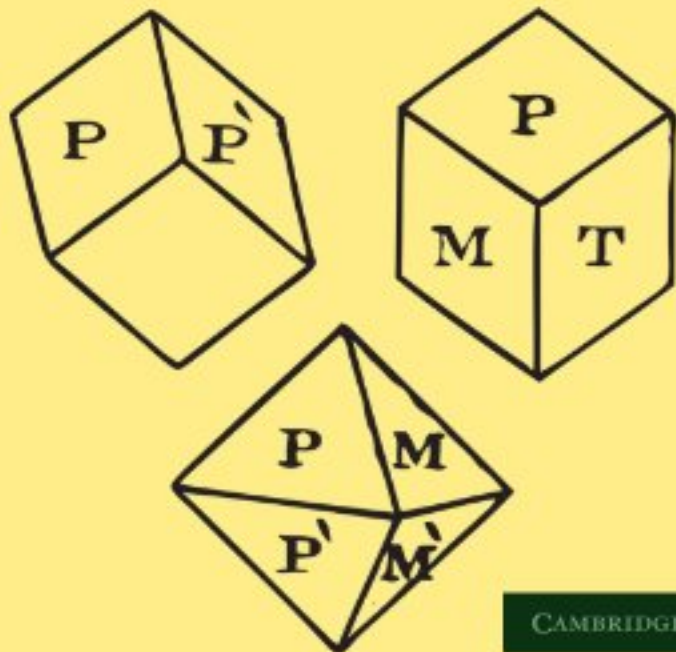


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A SYLLABUS OF A COURSE OF LECTURES ON MINERALOGY

JOHN STEVENS HENSLOW



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A Syllabus of a Course of Lectures on Mineralogy

John Stevens Henslow (1796–1861) was introduced to geology by Adam Sedgwick in 1819, and became Professor of Mineralogy at Cambridge in 1822. He soon moved to a chair in Botany, and not long afterwards became a teacher and mentor to Charles Darwin. This book on mineralogy was first published in 1823. It was intended to save time in class by providing an easily accessible reference to the composition of various minerals according to the principles of atomic theory, which was then entering the scientific mainstream. In that paradigm, analysis and examination of any mineral's composition involved first ascertaining the mineral's elementary molecules, both 'essential' and 'accidental', and second, determining the proportions in which the essential ingredients united to form the integrant molecule of the mineral. Henslow's book will interest historians of science tracing the development of atomic theory, and those working more broadly in the history of university education and the intellectual climate of the nineteenth century.

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on Mineralogy

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS

Cambridge New York Melbourne Madrid Cape Town Singapore São Paulo Delhi

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9781108002011

© in this compilation Cambridge University Press 2009

This edition first published 1823

This digitally printed version 2009

ISBN 978-1-108-00201-1

This book reproduces the text of the original edition. The content and language reflect the beliefs, practices and terminology of their time, and have not been updated.

SYLLABUS.

A
SYLLABUS
OF
A Course of Lectures
ON
MINERALOGY.



BY
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SECRETARY TO THE CAMBRIDGE PHILOSOPHICAL SOCIETY.

Cambridge :

Printed by J. Hodson, Trinity-Street,
AND SOLD BY J. DEIGHTON AND SONS.

1823.

P R E F A C E.

SOME explanation seems necessary for having deviated from the plan pursued by my predecessor, in forming his Syllabus of a Course of Lectures for the University.

Having compared the analyses (given by different authors) of various minerals, with the views established by the Atomic Theory, the results of some of these investigations appeared sufficiently important to merit the attention of those who might wish to pursue this subject; but as they are confined to calculations, which it would have been tedious both for a Lecturer to dictate and for his audience to transcribe, it seemed preferable to print them. From a similar consideration, the specific gravities and other properties, which require numerical exposition, have been inserted

in the Syllabus. Since, however, these calculations, if added to the notices of the different subjects to be detailed under each species, would have augmented the size of a work of this nature considerably beyond its ordinary limits, it became necessary to deviate entirely from the mode originally adopted by Dr. CLARKE. I have therefore supposed the description of each species to be divided into nine different heads, and the objects which each head is intended to include are collected between pages 2 and 6. From these will be selected, for every species, whatever may appear most worthy of engaging the attention; although reference is seldom made in the remainder of the Syllabus to any but such as embrace the description of some peculiar form, or involve numerical explanation.

The figures in page 3 are intended as general representations of a rhomboid, quadrangular prism, and octohedron; to these, for the sake of brevity in denoting the angles of the primitive forms, reference is occasionally made throughout the Syllabus, (under head II. for each species.) The mention of the regular solids of course does not stand in need of such assistance.

Many of the theoretic results, as well as some other notices, are not to be considered as conclusions upon which any reliance can be fixed, or as exhibiting my own opinions upon the subject. They are to be viewed merely as memoranda, printed for the sake of saving trouble in the lecture-room. Neither are the arrangement and nomenclature intended to form a sketch of any system of Mineralogy. The order pursued is that which appeared best adapted, in a short and elementary course of lectures for the University, to impress some knowledge of minerals upon those who may wish to acquire it, and assist others in their desire of prosecuting the study.

Perhaps it will not be considered misplaced if I here mention the methods which have been adopted in making the calculations alluded to, since they appear to be the most convenient for investigating the composition of any mineral according to the principles of the Atomic Theory. In the examination of any analysis there are two questions to be solved. First, to determine the proximate principles, or state of chemical combination in which the elementary particles exist in the mineral; in other words, to ascertain its

component, (or, as they are usually styled, elementary) molecules, both essential and accidental. Secondly, to select the essential ingredients, and ascertain the proportions in which they unite to form the integrant molecule. Without considering the various collateral circumstances which might influence the determination of the first question, we will speculate chiefly upon that evidence which may be drawn from the proportions between the different ingredients obtained by analysis. Taking the Bournonite as an example, we have,

	Analysis.	Rep. Nos.	Proportion of Atoms.	
Antimony	24.23	5.625	4.30 +	} = $\left\{ \begin{array}{l} 430 \\ 327 \\ 160 \\ 34 \\ 850 \end{array} \right\}$ nearly
Lead	42.62	13.	3.27 +	
Copper ...	12.8	8.	1.60	
Iron	1.2	3.5	.34 +	
Sulphur	17.	2.	8.50	

The first column of this Table contains the analysis given by Hatchet in the Philosophical Transactions (1804), quoted in page 41 of the Syllabus. In the second column are arranged the representative numbers (or weights of the atoms) of each substance, selected from the Table given at the end of this Preface.—Dividing the weights in the first column by the respective numbers in the second, the results

(placed in the third) shew the proportion between the *whole number of atoms* of the different substances contained in the mineral. And here, we may observe, that, when we have ascertained the component molecules, it is to this column we should look for the ingredient which is to mark the genus of the mineral, rather than to the weights in the original analysis. For we may fairly conclude that the character of the mineral will, *cæteris paribus*, be stamped by that substance which employs the greatest number of atoms towards its composition. Where the contrary is the case, of which an example will presently be given, we must look to other causes for explaining the phenomena. Should the representative number of that substance which employs the greater number of atoms be considerably less than the representative number of one of the other substances, it may happen that the weight of the former ingredient will be much less than that of the latter; which is the case in the example selected. Omitting the sulphur, which cannot mark the genus, we have among the four metals, the atoms of Antimony to those of Lead nearly as 430 : 327, whilst the weights of those metals are

as 242 : 426 (nearly). Hence I would rather class this substance with the ores of Antimony than with those of Lead, with which it has been usual to place it.

It appears that the sum of the atoms of the four metals does not greatly exceed those of the sulphur; we may therefore conjecture that each metal exists in the form of a sulphuret. Calculating the quantity of sulphur requisite to fulfil this condition, the result given in page 41 is obtained, by which it appears that the sulphur required (theoretically) exceeds the quantity actually obtained by experiment by $2.04 +$; but as this error should not fall upon the sulphur alone, the mean error for five ingredients would be only $.40 +$.*

In calculating the quantity of sulphur requisite, we may multiply the atoms of the respective ingredients by 2 (the representative number for sulphur); but, in general, the more correct method is to obtain it by a simple proportion, which avoids

* This exposition is not strictly accurate, since the error, if divided among five ingredients of different representative numbers and weights, would be greater for some than others; but it is sufficiently near to strengthen (as a general conclusion) the probability that the mineral is composed of four *sulphurets*.

the possibility of error arising from a neglect of decimals beyond the tenth or hundredth places.

These calculations are founded upon the supposition that the original analysis is perfectly correct, but it is evident that one source of error may arise from the adoption of different representative numbers from those used in calculating for the analysis from the various precipitates obtained by experiment. For example, if the original calculations in this analysis of the Bournonite had been made with the numbers here adopted, it would have stood,

Analysis.	Precipitates.
Antimony 23.23	derived from Per-ox. Ant.... 31.5
Lead ... 39.06	..... Sulphate Lead 60.1
Copper.... 12.8	..... Per-ox.Copper 16.
Iron 1.2	..... Iron..... 1.2
Sulphur .. 17.	..... Sulphur 17.

and consequently the proportion between the *atoms* of the whole, would have been (nearly) as,

Antimony	412	}
Lead	300	
Copper	160	
Iron	34	
Sulphur	850	

which will not affect the conclusion originally established, that each metal is united with the

sulphur, whilst it actually brings the sum of their atoms still nearer to those of the sulphur. As it would have been impossible to have reduced many of the original analyses in this manner, without more trouble than the subject merits, these are, for the most part, presumed to be strictly accurate, and the error will seldom be found of sufficient magnitude to affect the general result, unless where late experiments have led to a considerable change in the value of a representative number.

The second part of the problem we are attempting to solve, is to estimate the ingredients (and the proportion of each) *essential* to the composition of the integrant molecule which stamps the crystalline character of the mineral. The views of Haüy on this subject have been adopted, which ascribe to every different form in the integrant molecule a peculiar combination of elementary bodies. The doctrine of Isomorphic bodies, supported by Berzelius, and strenuously opposed in the last edition of Haüy's Mineralogy, seems as yet to rest upon such shallow foundation, that it would be premature to consider it as established, until it shall have received a greater accession of strength, or until it shall be shewn

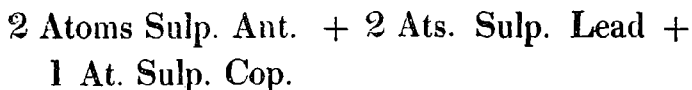
that the more simple hypothesis is untenable. Nothing can be easier than to adapt a set of the symbols invented by Berzelius to any analysis, and if we are to suppose that all (or even, in some cases, the greater part) of the ingredients exhibited by every accurate analysis of the same mineral to be essential to the composition of the integrant molecule, crystallographically considered, we must no longer expect precision in this department of Natural History. In some cases, the evidence for the adventitious character of an ingredient is clear; in Fontainbleau Spar (see page 63), the weight of the silica forms more than two-thirds of the mass, and the atoms of silica are to those of the carbonate of lime in a greater ratio than 6 : 1, yet no doubts are entertained of the crystalline character having been impressed by the smaller ingredient. The difficulty of conceiving the form of certain homogeneous and transparent minerals to have been impressed by a small portion of their ingredients, may perhaps be diminished by considering that various substances are capable of holding others in *solution*, where we suppose an admixture perfectly homogeneous to take place without the formation of any new integrant mole-

cule, and it does not seem improbable that this principle may admit of further extension than has hitherto been ascribed to it. In this light, steel might be considered as a solution of carbon in iron; plumbago a solution of iron in carbon; naptha a solution of carbon in olefiant gas, &c. Several metallic alloys might be mixtures of this nature.—Such a combination among the earthy minerals would most readily be effected by the agency of heat, and in such a case it should seem, that the greater the degree of fluidity, the purer (and perhaps less complicated) would be the simple minerals formed upon the cooling of the mass. In all mixtures or solutions of this kind, we might have the ingredients in a variety of proportions, up to the points of saturation for each, and still the form impressed upon the mass as it became solid, would arise from the crystallization of one only.

Without considering the causes which may have brought together the ingredients composing the Bournonite, let us suppose them homogeneously mixed, the question is, whether any of the four Sulphurets enter into a new combination, and thereby form a new integrant molecule, or

whether the character is impressed by the crystallization of one in particular.

As it is evident that the number of atoms of the Sulphurets must exactly correspond to those of the Metals, by inspecting the third column of the Table, (page viii. of the Preface,) it is plain that the only combinations which would come within the principles of the Atomic Theory, would be either,



Or, $1 \text{ At. Sulp. Ant.} + 1 \text{ At. Sulp. Lead.}$

In the first instance we must allow the excess of the Sulphurets of Lead and Antimony, together with all the Sulphuret of Iron, to be mechanically mixed with the essential ingredients. In the second, the whole of the Sulphurets of Copper and Iron, together with the excess of the Sulphuret of Antimony, would form the accidental portion.

A single analysis, however, appears insufficient to decide this question, chemically considered. If the primitive form of the Bournonite should be proved to be distinct from that of the Sulphuret

of Antimony, then there can remain no doubt of its being entitled to form a distinct species. I have had no opportunity of investigating this point, but from the accounts given of these Minerals by Haiiy, Bournon, and Phillips, it does not appear that their Crystals have been compared, and as the measurements given of some of their corresponding angles are nearly identical, it does not seem improbable that the form of each may have been impressed by similar integrant molecules.

According to this view of the subject, the essential composition of an impure Crystal could never be ascertained from the inspection of a single analysis, however accurately performed. Several analyses, undertaken upon crystallized specimens, selected from different matrices, would be requisite to point out those ingredients which were adventitious to the essential character.— Among the numerous analyses of Augite (from which have been selected those given in page 88,) I can find only one in which Magnesia does not enter as an ingredient, and as there is sometimes considerable difficulty in separating this Earth from Lime, it may possibly here have escaped

detection. Omitting, therefore, this analysis as doubtful, I would offer the following conjectures respecting the composition of the Integrant Molecule of this Mineral.—As the primitive form of Diopside is identical with that of Augite, I consider it (from its transparency) as the purest state in which this Mineral is known to occur. From the only analysis hitherto given of it, (see page 87,) the composition of its integrant molecule approaches nearest to a compound of the Bisilicates of Lime and Magnesia, atom to atom. The two analyses of Sahlite (see page 88), the variety of Augite next in purity to the Diopside, would lead to the same result, and even with a much greater degree of probability. Now, with the exception above-mentioned, the three ingredients, Silica, Lime, and Magnesia, are found in all the other analyses of Augite: in that given by Simon, the proportion between these ingredients appears least likely to afford a satisfactory result; but upon examining the proportion between the atoms of each, it does not seem unlikely that there are a sufficient number of integrant molecules of the nature above-mentioned, to effect the crystallization of the whole.

	Analysis.	Rep. Nos.	Atoms.
Silica.....	52.	2.	260
Lime.....	25.5	3.625	70
Magnesia	7.	2.5	28
Ox. Iron	10.5	5.5	19
Alumina	3.5	3.375	10
Ox. Mang....	2.25	4.5	5
Water .....	.5	1.125	4

It is evident that the number of integrant molecules employed must depend upon the number of atoms of Magnesia, which is the least of the three essential ingredients. Hence, as the atoms of Silica are twice those of the Lime and Magnesia, we shall have 28 Integ. Mols. = 112 atoms Sil. + 28 Lime + 28 Mag.; and therefore there will remain in excess, 148 atoms Sil. + 42 Lime + sum of the atoms of the other substances. All the atoms of Silica in excess might be united with the other ingredients, forming different silicates, but if we suppose them united only to the excess of Lime and Alumina, we have,

42 ats. of Bisil. Lime = 42 Lime + 84 Sil.

10 ats. of Bisil. Alum. = 10 Alum. + 20 Sil.

and therefore the atoms of Silica uncombined, are reduced to 44. Hence, the proportion between the whole of the atoms of the various component molecules would stand thus :

	Atoms.
Integrant Molécules,	}
<i>i. e.</i> Bisil. Lime + Bisil. Mag.		... 28
Bisil. Lime	42
Bisil. Alumina	10
Silica	44
Ox. Iron	19
Ox. Manganese.....	5
Water	4

Consequently, atoms essential : atoms accidental : : 28 : 124, a greater ratio than 1 : 5, from which it appears, that the essential atoms bear a greater proportion to the accidental than in the case of the Fontainbleau Spar. But in the present instance we must also recollect, that the accidental ingredients are not all of the same nature, and therefore are not so likely to oppose the crystallization of those which are essential.—In fact, the atoms of the essential ingredient are to the atoms of that accidental ingredient which is in the greatest excess (*viz.* Silica) as 28 : 44, which is a greater ratio than 1 : 2.

In our present state of knowledge, it is impossible to draw any satisfactory arguments from the comparative magnitude and crystallizing energies of the integrant molecules of different minerals ; it may, however, be suggested, that the dimensions of the more complicated integrant molecules are more likely to be larger than the others

and would consequently require a smaller number to produce a crystal of given dimensions, whilst the latter might easily be included in the cavities between them. It is precisely in minerals of this kind, where the integrant molecule is supposed to consist of 4 or 5 elementary bodies, that the greatest confusion prevails—Ex. gr. Garnet, Hornblende, Tourmaline, &c.

It should be remarked, that the excess in the accidental atoms, in the foregoing example of the Augite, would be considerably diminished by every slight addition made to the weight of the Magnesia (in the original analysis) at the expense of the Lime; and that if about six parts were taken from the Lime and added to the Magnesia, there would no longer be any excess of the atoms of the former, and the excess of those of the Silica would be diminished, whilst the number of the essential atoms would be increased in a greater ratio than 52 : 28, that is to say, would be about doubled.

In all attempts to reduce the analyses of siliceous minerals by the principles of the atomic theory, the greatest difficulty will be found to occur among those which contain an alkali, apparently as an essential ingredient. This substance

almost universally exists (according to the analyses hitherto made) in far too small a quantity to admit of the common adaptation of the theory. Is it likely that some portion may still be retained in combination with the silica? Several analyses might, upon such a supposition, be easily brought within the theory, whilst at present the silica is considerably in excess. But the examples already given have extended this Preface beyond the limits which it was intended to occupy. The chief object in view was to shew, "That when we wish to ascertain the essential ingredients of any crystal, one part of the investigation may be more easily and more correctly deduced, from inspecting the proportion between the absolute *number of atoms* employed in its composition, than between the weights of each ingredient."

In the following Table are given the representative numbers of the Component Molecules of Minerals, which have been adopted in the calculations throughout the Syllabus. They have been selected from various sources, according as each appeared most worthy of insertion.—Some few, which differ from those hitherto published, were calculated from a comparison of different

analyses. They are all multiples of .125, the number assumed for hydrogen, not from the idea that this construction (now usually adopted) is strictly true, since it does not appear that the basis upon which such a theory is founded, can be made sufficiently accurate to determine the question; for, whatever may be the representative number of any substance, as deduced from experiment, if it be not an exact multiple, it must always lie between two multiples of hydrogen, and consequently the difference between this number and one of these multiples cannot exceed half the number assumed for hydrogen; and it will be found, by examining different analyses, that even this difference is generally far too small to create any sensible error in the result. On the present scale, the greatest difference between the number deduced from experiment, and the multiple of hydrogen nearest to it, could not exceed .0625.—As a matter of convenience therefore, and not as a point determined in chemistry, it may be advisable to select the multiples of hydrogen nearest to the numbers given by experiment, and on this account alone has the present Table been so constructed.

ALPHABETICAL LIST
OF THE
COMPONENT MOLECULES OF SIMPLE MINERALS,

With the relative Weights of their Atoms.

<p>Alumina 3.375 Aluminum ? Ammonia 2.125 Antimony 5.625 Oxide of..... 6.625 Arsenic 5.25 Arsenic Acid..... 7.25 Barytes 9.75 Bismuth 8.875 Oxide of..... 9.875 Boracic Acid..... 2.75 Boron..... .75 Carbon75 Carbonic Acid 2.75 Cerium, Oxide of ..12.5 ? Chromic Acid 6.5 Cobalt..... 5.375 Peroxide of 7.375 Columbium ? Oxide of ? Copper 8. Peroxide of10. Fluoric Acid 2.125 Glucina 3.25 Gold16.5 ? Hydrogen125 Iridium 6. ? Iron..... 3.5 Peroxide of 5.5 Protoxide of 4.5 Lead13. Peroxide of15. Lime 3.625 Magnesia 2.5 Manganese 3.5 Protoxide of 4.5 Mellitic Acid..... ?</p>	<p>Mercury25. Peroxide of27. Molybdenum..... 6. Molybdic Acid 8. Muriatic Acid 4.625 Nickel 3.75 Oxide of 4.75 Nitric Acid 6.75 Oxygen 1. Palladium14. ? Phosphoric Acid 3.5 Platinum12.5 ? Potash 6. Hydrate of 7.125 Selenium 5.125? Silica 2. Silicium ? Silver13.75 Deutoxide of15.75 Soda 4. Hydrate of 5.125 Sulphur 2. Sulphuric Acid 5. Strontian 6.5 Tellurium 4.75 Tin 7.375 Tungstic Acid15. Titanium..... ? Uranium.....15.5 Oxide of17.5 Water 1.125 Yttria 5. Zinc..... 4.375 Oxide of 5.375 Zirconia 5.625</p>
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Some of the following Books are among the most useful to those commencing Mineralogy:—

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E R R A T A.



Page 8, line 4.	For Light	<i>read</i> No light.
— 10, — 6.	— mamellated	— mamillated.
— —, — 10.	— 85° 45'	— 94° 15'.
— 23, — 10.	— symetrical	— symmetrical.
— —, — 11.	— 10	— 200.
— 36, — 17.	— symetrical	— symmetrical.
— 47, — 12.	— :: 1000 : 1	— :: 1 : 1000.
— 54, — 13.	} — symetrical	— symmetrical.
— —, — 19.		
— 55, — 11.		
— 79, — 12.	— 10.6	— 10.5

A Syllabus

OF

LECTURES ON MINERALOGY.

DIVISION of Natural History into three branches—subdivision into two—distinction between organized and unorganized bodies—Minerals, simple and compound.

Elementary bodies—compound substances. Definition of a simple Mineral—integrant molecule—component (or elementary) molecules.

Ex. gr. Sulphuret of Iron—carbonate of Lime. Definition of a compound Mineral—*ex. gr.* Granite.

Distinction between Mineralogy and Geology—mode of pursuing the study of Mineralogy—want of a precise arrangement—number of species inconsiderable.

Method of identifying species—characters of Minerals—terms used in Mineralogy—subdivision of Physical and Chemical characters.

I. ESSENTIAL CHARACTER.

Composition of the integrant molecule—analysis of Minerals—estimation of the essential and accidental ingredients.

II GEOMETRIC CHARACTERS.

Crystallization—definition of a crystal—to every Mineral a certain series of crystals—*ex. gr.* Quartz—some forms common to different species.

Secondary crystals artificially constructed by the addition of integrant molecules to a primitive nucleus.

Laws of decrement :

1st. On the Edges—*ex. gr.* Rhomboidal and pentagonal dodecahedrons derived from the Cube.

2d. On the Angles—*ex. gr.* Regular octohedron derived from the Cube.

3d. Mixed decrements.

4th. Intermediate decrements.

Subtractive molecules.

Compound secondary crystals—*ex. gr.* Icosahedron.

Regular pentagonal dodecahedron and regular icosahedron incompatible with the laws of crystallization.

Number of crystalline forms—laws of decrement limited in nature.

Natural mode in which crystals are formed—from solution—from fusion.

Progress of crystallography—opinions of Linnaeus—Tournefort—Romé de l'Isle—Bergman—Haüy.

All crystals of the same species reducible to one form—cleavage—*ex. gr.* Rhomboid extracted from all crystals of carbonate of lime—some primitive forms common to different species—Structure—Fracture.

Five kinds of primitive forms :

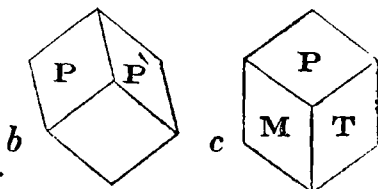
1. Regular tetrahedron.

2. Parallelopipeds.

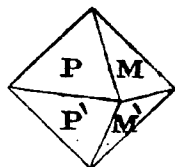
(a) Cube.

(b) Rhomboid.

(c) Quadrangular prisms.



3. Octohedrons.



4. Regular hexahedral prism.

5. Rhomboidal dodecahedron.

Forms of some integrant molecules differ from

those of the primitive crystals—three kinds of integrant molecules:

1. Tetrahedrons.
2. Triangular prisms.
3. Parallelopipeds.

III. EXTERNAL CHARACTERS.

Regular crystals—their form supposed to be independent of the relative magnitude of their faces—method of determining their form by the common goniometer—reflecting goniometer.

Hemitrope crystals.

Indeterminate crystallization—*ex. gr.* lenticular—acicular—striated—fibrous.

Concretions—stalactites and stalagmites—in-crustations—petrefactions—pseudomorphous crystals—amorphous masses.

IV. PHYSICAL CHARACTERS.

Specific gravity $\left\{ = \frac{\text{weight}}{\text{wt. lost in water}} \right\}$ estimated by the common scales—Hydrostatic balance—Nicholson's balance.

Cohesion of the Particles—Hardness, estimated by the file—point of the knife—mutual action of substances—percussion with steel wheel—Fragibility—difference between fragile and tender bodies.

Flexibility—Elasticity—Malleability—Ductility.
Action of light—Transparency—translucency
 —opacity.

Colour—from reflection and refraction—essential and accidental—chatoyant—irised—scratch—streak—powder.

Double refraction—Polarization of light—Phosphorescence—produced by heat—friction—after exposure to light.

Touch—adhesion to the tongue.

Odour—produced by breathing, friction, and heat.

Taste.

Magnetism—with and without polarity—double magnetism.

Electricity—positive and negative; or vitreous and resinous—excited by friction—heat—pressure.

V. CHEMICAL CHARACTERS.

Action of Heat—excited by the common blow-pipe—hydraulic blowpipe—gas blowpipes.

“ Apparatus for the common blowpipe :

“ *Supports*—Charcoal from pine-wood or willow

“ —Platina-foil, wire, and forceps—glass-tubes—

“ bone-ash and tobacco-pipes.

“ *Re-agents*—Carbonate of soda—borax—glass

“ of borax—phosphate of soda and ammonia—

“ nitre.”

*Action of water and the atmosphere—
Action of acids—Nitric—muriatic—sulphuric—
Action of alkalis—
Alloys.*

VI. EXTRANEOUS CHARACTERS.

VII. DISTINCTIVE CHARACTERS.

VIII. GEOLOGICAL AND GEOGRAPHICAL POSITIONS.

IX. USES AND OBSERVATIONS.



HYDROGEN—OXYGEN—WATER—
OXIDES — ACIDS — ALKALIS — EARTHS.

GENUS I. SULPHUR.

S. G. = 1.9907—Purification—Artificially crystallized from fusion or solution—casts.

Species 1. Native Sulphur.

ii. *Prim.* rhomboidal octohedron P.P' = $143^{\circ} 7'$.

iii. Crystals 6. Amorphous—disseminated—pulverulent.

iv. S. G. = 2.0332.

viii. Volcanic and other native sulphur compared.

Species 2. Sulphuric Acid.

Its extensive uses in chemical operations and the arts.

GENUS II. CARBON.

Charcoal—uses in Chemistry—metallurgy—steel—printing ink—fuel.

Species 1. Diamond.

- II. *Prim.* regular octohedron.
 III. Crystals.
 IV. S. G. = 3.5 to 3.6—Light refracted if the angle of incidence is greater than $24\frac{1}{2}^{\circ}$.
 IX. Art of polishing Diamonds—Diamond powder—the cutting Diamond.

APPENDIX I.

Mineral Carbon.

Plumbago—*Graphite*—*Black-lead*.

- I. Carbon 90.9 + Iron 9.1. Berthollet.
 III. Amorphous—disseminated.
 IV. S. G. = 2.08 to 2.32.
 IX. Black-lead pencils—recent and artificial formations of Plumbago.

Anthracite—*Blind Coal*—*Stone Coal*.

- I. Carbon 72.05 }
 Silica 13.19 } Phillips.
 Alumina .. 3.29 }
 Ox. Iron .. 3.47 }
- III. Amorphous—slaty—columnar.
 IV. S. G. = 1.4 to 1.8.

APPENDIX II.

Carburetted Hydrogen.

Mineral Oils.

(a) Naptha.

	Sauss.	Theory.		
I. Carbon	87.21	10.47	|	|
—————	—————	76.74			1
Hydrogen	12.79	12.79	|	1

(b) Petroleum.

Mineral Bitumens.

(a) Earthy—*Maltha*.

(b) Elastic—*Mineral Caoutchouc*.

(c) Compact—*Asphalt*.

S. G. = 1. to 1. 6.

Mineral Resins.

(a) Amber—*Electrum*.

III. Amorphous—*Stalactitic*.

IV. S. G. = 1.078 to 1.085.

(b) Fossil Copal—*Highgate Resin*.

III. Amorphous.

IV. S. G. = 1.046.

(c) Retinasphalt.

Coals.

(a) Jet.

(b) Cannel Coal—39 to 75 per cent. of Carbon, with Bituminous oil and earth.

IV. S. G. = 1.2.

(c) Common Coal—*Black Coal*.

I. Carbon 56.8 + Asphalt and Maltha 43.

IV. S. G. = 1.2 to 1.3.

(d) Lignite—*Brown Coal*.

APPENDIX III.

Carbonic Acid.

GENUS III. BORON.

Species 1. Boracic Acid.

	Gmelin.	Berz.	Theory.
Boron	74.4	74.17	72.5 + | 1 |
Oxygen	25.6	25.83	27.4 + | 2 |

III. Mamellated incrustations.

IV. S. G. = 1.48.

GENUS IV. SILICIUM.

Species 1. Silica—*Quartz*.

II. *Prim.* Obtuse rhomboid P. P' = 85° 45'.

III. Crystals 13. Acicular—fibrous—granular—arenaceous—concretionary—stalactitic—pseudomorphous—amorphous.

Rock Crystal—Amethyst, 97.5 per cent. of Silica—*Milk—Rose—Smoky—Fat—Avanturine—irised—ferruginous—Elastic*.

Hyalite $\left. \begin{array}{l} \text{Silica} \dots 92 \\ \text{Water} \dots 6.33 \\ \text{Loss} \dots 1.66 \end{array} \right\} \text{Bucholtz.}$

IV. S. G. = 2.0499 to 2.816.

VI. Cat's-eye.

Chalcedony.

Silica	83	|	84	} Berzelius.
Alumina	2	|	16	
Lime	11	|	..	

Onyx—Sard — Sardonyx — Cachalong—Carnelian
—Plasma—Prase—Crysoprase — Heliotrope or
Bloodstone.

Agate—Ribbon—Brecciated—Fortification—Moss
—Mocha-stone.

Flint — Chert — Hornstone — Swimming Flint —
Siliceous Sinter.

Opal — precious — Hydrophane — Semi-Opal —
Wood Opal—Ferruginous—Menilite.

Jasper—43 to 80 per cent. of Silica—Common—
Jasper-Opal—Ribbon—Egyptian Pebble—Por-
cellanite.

GENUS V. ARSENIC.

Dyes and Paints—Artificial gems.

Species 1. Native Arsenic.

ii. *Prim.* Regular octohedron.

iii. Amorphous—Concretionary.

iv. S. G. = 5.67 to 5.7633.

Species 2. Oxide of Arsenic.

	Proust.	Theory.		
i. Arsenic	75	|	72.41 +	| 1 |
Oxygen	25	|	27.58 +	| 2 |

- II. *Prim.* Regular octohedron.
 III. Crystal 1. Acicular—pulverulent.
 IV. S. G. = 3.706 to 5.
 Of Arsenic Acid.

Species 3. Sulphuret of Arsenic—*Realgar*.

	Then.	Klap.	Theory.	
I. Arsenic	75	69	72.41 +	1
Sulphur	25	31	27.58 +	1

- II. *Prim.* Oblique rhomboidal prism.
 III. Crystals 3. Acicular — concretionary — disseminated—amorphous.
 IV. S. G. = 3.3384 to 3.35.
 IX. Its uses among the Chinese—Paint.

Species 4. Bi-sulphuret of Arsenic?—*Orpiment*.

	Klap.	Then.	Theory.	
I. Arsenic	62	57	56.75 +	1
Sulphur	38	43	43.24 +	2

- III. Laminar—disseminated—amorphous.
 IV. S. G. = 3.35 to 3.4522.
 IX. Uses among the Turks—Paint—preparation of artificial orpiment.

GENUS VI. MOLYBDENUM.

S. G. = 7. to 8.611.—Molybdic Acid.

Species 1. Sulphuret of Molybdenum.

	Pell.	Seybert.	Buch. & Theory.
I. Molybdenum	45	59.42	60
Sulphur	55	39.68	40
Loss . . . . .	.	.9	..
			1
			2

III. Crystals 2. Amorphous.

IV. S. G. = 4.5 to 4.74.

TUNGSTEN and Tungstic Acid.

CHROME and Chromic Acid.

GENUS VII. IRON.

S. G. = 7.788—Its great abundance and numerous uses—steel.

Species 1. Native Iron.

I. Iron 92.5 to 94 per cent.

III. Amorphous—plated, ramose, cellular.

VIII. Volcanic and Meteoric.

Meteorites—Alloy of Iron 98.5 + Nickel 1.5.

S. G. = 6.48 to 7.4.

Species 2. Peroxide of Iron. *Specular Iron ore—fer oligiste.*

	Hass.	Theory.
I. Iron	69	63.63 +
Oxygen	31	36.36 +
		1
		2

- II. *Prim.* Acute rhomboid P.P' = 86° 10'.
 III. Crystals 6—Lamelliform.
 IV. S. G. = 5.

Species 3. Oxydulated Iron—Magnetic Iron Ore.

	Berz.	Theory.	
I. Protox. Iron	28.14	29.0 +	1
Perox. Iron	71.86	70.9 +	2
Buch.			
Iron	70	} or {	Protox. Iron . . 49.5
Oxyg.	29			} Perox. Iron . . 49.5

- II. *Prim.* Regular octohedron.
 III. Crystals 3. Lamelliform—Compact (*native loadstone*)—Earthy.
 IV. S. G. = 4.4.
 VI. Titaniferous—S. G. = 4.6 to 4.9.
 Oxide Titan. . . 8 to 15.9 } per cent.
 Oxide Iron 79 to 98.7 }
 Chromiferous—*Chromiron*—Chrome 2 per cent.

APPENDIX I. Red Iron Ore.

Var. 1. Fibrous—Red Hæmatite.

- I. Ox. Iron 90 per cent.
 III. Botryoidal—Stalactitic.
 IV. S. G. = 4.7 to 5.

Var. 2. Compact.

- III. Cubic (pseudomorphous?)—slaty—amorphous.
 IV. S. G. = 3.5 to 5.

Var. 3. Scaly.

- i. Iron 66.0 + Oxygen 28.5 + Sil. and Al. 5.5
Henry.

Var. 4. 5. Red Ochre—Red Chalk, (Reddle.)

APPENDIX II. Brown Iron Ore.

Var. 1. Cubic (pseudomorphous?)

Var. 2. Fibrous—Brown Hæmatite.

	Vauq.	Theory.	
i. Peroxide Iron	80.25	73.3 +	1
Water	15.	15.	1
Silex	3.75		

iii. Mamillary—stalactitic.

iv. S. G. = 3.7 to 4.

Var. 3. Compact. Peroxide Iron 84 per cent.

iv. S. G. = 3.5 to 3.7.

Var. 4. Scaly. Var. 5. Ochreous.

*Var. 6. Umber—Ox. Iron 48, Ox. Mang. 20,
per cent.*

APPENDIX III. Black Iron Ore.

Var. 1. Fibrous—Black Hæmatite.

iv. S. G. = 4.7.

Var. 2. Compact. Var. 3. Ochreous.

APPENDIX IV.

Jaspery Iron Ore — Clay Iron Stone — Bog Iron
Ore — Pitchy Iron Ore.

Species 4. Sulphuret of Iron. Magnetic Iron Pyrites.

Hatchet. Theory.

I. Iron	63.5	|	63.63	|	1	|
Sulphur	36.5	|	36.36	|	1	|

II. *Prim.* Right rhomboidal prism.

III. Crystals—amorphous.

IV. S. G. = 4.51.

Species 5. Bi-sulphuret of Iron. Iron pyrites.

Hatchet.

I. Iron	47.85	|	Hatchet.			|	Theory.	|
			47.5	|	47.3				|	46.4
Sulphur.	52.15	|	52.	|	52.7	|	53.6	|
							46.66	|
							53.33	|
							2	|

Bucholtz Theory. Proust Theory.

Iron	44.85	|	44.75	||	47.36	|	46.06	|	1	|
Sulphur.	51.15	|	51.15	||	52.64	|	52.64	|	2	|

II. *Prim.* Cube.

III. Crystals 40. Amorphous—pseudomorphous.

IV. S. G. = 4.6 to 4.8.

VI. White Iron pyrites.

Hatchet Theory.

Iron	45.66	|	45.66	|
Sulphur	54.34	|	52.18 +	|

Arsenical Iron pyrites—Auriferous.

Species 6. Sulphate of Iron—Green vitriol.

Berg. Theory.

i. Iron.....	23	26.9 +	1
Sul. Acid....	39	38.4 +	1
Water.....	38	34.6 +	4

ii. *Prim.* Acute rhomboid P. P. = 81° 23'.iii. Crystals 7—fibrous—pulverulent—amorphous
—stalactitic.*Species 7. Carbonate of Iron—Spathose Iron
—Brown Spar.*

Bert. Theory. Bayen Theory.

i. Protox. Iron ..	57.	57.	66	55.6	1
Carb. Acid	35.	34.8 +	34	34.	1
Manganese....	1.5	&c.			
Magnesia	5.5				
Loss	1.				

ii. *Prim.* Obtuse rhomboid P. P' = 107°.

iii. Crystals—fibrous—amorphous.

iv. S. G. = 3.6 to 3.8.

Species 8. Phosphate of Iron.

Laugier Theory. Cadet Theory.

i. Iron	41.25	41.25	1	41.1	41.1	1
Phos. Acid	19.25	32.08	1	36.9	31.9	1
Water ..	31.25	10.31	1	13.1	10.2	1
.....		8.11		....	7.8	
Silica	1.25	&c.		3.	&c.	
Alumina..	5...			5.8		
Lime				9.1		

	Bert. Theory.	Vauq. Theory.	Klap Theory.	Theory.		
Iron	43.	43	31	31	47.2	47.2
Phos. Acid	23.1	33.4	27	24.1	32.	36.7
Water	34.4	10.7	..	7.7	20.	11.8
.....		13.3	..	...	..	4.5
Mang.	3	...	42	...		

II. *Prim.* Oblique rectangular prism.

III. Crystals 12. Earthy.

IV. S. G. = 2.697.

Species 9. Silicate of Iron.—*Yenite.*

	Hising. Theory.	Vauq. Theory.			
I. Iron	55.	57.5	57.5	1	
Silica	28.	23.3 +	30.	25.5 +	1
.....		4.6 +	..	4.4 +	
Lime	12.	&c.	12.5	&c.	
Alum. . . . .	.6		..		
Mang.	3.		3.		
Loss	1.4		..		

II. *Prim.* Rectangular octohedron $P.P' = 113^\circ 2'$.

III. Crystals 6.—Acicular—amorphous.

IV. S. G. = 3.8.

Species 10. Arsenical Iron.—*Mispickel.*

	Phill. Theory?	Vauq. Strom. Thom.				
I. Arsenic	42.1	42.85 +	1	53.	42.88	48.1
Iron	58.9	57.14 +	2	19.7	36.04	36.5
Sulphur . . . . .		....		15.3	21.08	15.4

- II. *Prim.* Right rhomboidal prism. M. T. =
111° 18'.
- III. Crystals 40.—Amorphous.
- IV. S. G. = 5.6 to 6.5223.

Species 11. Arseniate of Iron.

Chenevix Vauq.

I. Ox. Iron	..45.5	48
Ars. Acid	..31.	18
Water	....10.5	32
Silica	.... 4.	..
Lime	..... ..	2
Copper	.... 9.	..

- II. *Prim.* Cube.
- III. Crystals 4.—Concretionary—amorphous.
- IV. S. G. = 3.

Species 12. Chromate of Iron.

	Tassaert	Vauq.	Laug.	Klap.	
I. Ox. Iron	....36.	34.7	34.	33.6	
Chromic Acid	63.6	43.	53.	55.5	
Silica	..... ..	2.	1.	2.	
Alumina	..... ..	20.3	11.	6.	
Loss	..... 4	..	1.	3.5	
Ox. Iron	....40.9 +	29.7	34.	33.6	1}
Chrom. Acid	59.0 +	43.	49.1	36.3	1}
					Theory

- II. *Prim.* Regular octohedron.
- III. Octohedron?—granular—amorphous.
- IV. S. G. = 4.03.

Species 13. Tungstate of Iron.—Wolfram.

	Berzel.	Elhuy.	Vauq.	Klap.
i. Ox. Iron	18.32	13.5	18.	31.2
Tung. Acid	78.77	65.	67.	46.9
Mang	6.22	22.	6.25	..
Silica	1.25	2.	1.5	..
Loss . . . . .	..	..	7.25	21.9
Ox Iron	18.32	13.5	18	1
Tung. Acid	61.06	45.	60	1

} Theory.

ii. *Prim.* Right rectangular prism.

iii. Crystals 3.—Amorphous.

iv. S. G. = 7.1 to 7.3.

GENUS VIII. NICKEL.

S. G. = 8.5 to 8.93. Plates $\frac{1}{100}$ inch thick—
Magnetic power of Nickel : Iron :: 1 : 4 nearly—
or as 35 : 55 (Lampadius).

Species 1. Native Nickel.

iii. Capillary.

Species 2. Arsenical Nickel—Copper Nickel.

	Strom.	Theory.
i. Nickel	44	41.25 | 1
Arsenic	55	57.75 | 1
Iron	} 1	|
Lead		
Sulphur		

- III. Six-sided prism? — reticulated — dendritic — concretionary—amorphous.
 IV. S. G. = 6.6086 to 7.56.
 VI. Argentiferous.

Species 3. Arseniate of Nickel?—*Nickel Ochre.*

	Phill.	Klap.
I. Ox. Nickel	37	15.62
Arsenious Acid .37		....
Water	24	....
Ox. Iron	1	4.58
Sulp ^c . Acid	1	....
Silica		35.
Alumina		5.
Magnesia		1.25
Lime . . . . .		.4
Loss		37.
Arsenic Acid ?.. }		....

- III. Crystals—pulverulent—amorphous.

Species 4? Black Ore of Nickel.

GENUS IX. MANGANESE.

Species 1. Oxide of Manganese.

- II. *Prim.* Right rhomboidal prism M. T. = 100°.
 III. Crystals 6.—Acicular—earthy (*Wad.*)—amorphous.
 IV. S. G. = 3.7076 to 4.756.

- vi. Siliciferous—white, rose, and violet.
 ix. For clarifying and tinging glass—used for obtaining oxygen.

Species 2. Sulphuret of Manganese.

	Vauq.	Klap.
i. Mang.....	85	82
Sulph.....	15	11

- iii. Amorphous.
 iv. S. G. = 3.49 to 3.95.

Species 3. Carbonate of Manganese.

	Descot.	Lamp.
i. Ox. Mang.....	53.	48.
Carb. Acid	36 6	49.2
Ox. Iron	8.	2.1
Silex .....	..	9.

- iii. Amorphous.
 iv. S. G. = 2.8.

Species 4 Phosphate of Manganese.

	Vauq.
i. Ox. Mang.....	42
Phos Acid	27
Ox. Iron	31

- iii. Amorphous.

GENUS X. TIN.

S. G. = 7.291 to 7.299—Wire $\frac{1}{10}$ inch supports.
49.5 lbs.—tin foil—coating for iron plates.

Species 1. Per-oxide of Tin.

	Klap.	Theory.	Klap.	Theory.	
i. Tin	77.5	77.5	75.	75.	1
Oxygen	21.5	21.0	23.75	20.3	2
Iron .. . . .	.25	&c.	.5	&c.	
Silex .. . . .	.75		.75		

ii. *Prim.* Symetrical octohedron.

iii. Crystals 10—fibrous (*wood tin*)—concretionary
—granular (*stream tin*)—amorphous.

iv. S. G. = 6.76 to 6.95.

Species 2. Sulphuret of Tin?

	Klapr.	
i. Tin	26.5	34.
Sulph	30.5	25.
Iron	12.	2.
Copper	30.	36.

iii. Disseminated—amorphous.

iv. S. G. = 4.35 to 4.785.

GENUS XI. COPPER.

S. G. = 7.78 to 7.87 and 9. Wire $\frac{1}{10}$ inch supports 299 lbs.—Bronze — Bell-metal — Sheet-copper — 10844 Tons raised in Great Britain and Ireland in one year ending 30 June 1822.

Species 1. Native Copper.

- II. *Prim.* Cube or regular octohedron.
- III. Crystals 100.—Capillary — dendritic — amorphous.
- IV. S. G. = 7.6 to 8.5844.

Species 2. Protoxide of Copper.—*Red oxide of Copper—Ruby Copper.*

	Klap. Chen.	Theory.
I. Copper	91.	88.5
Oxygen	9.	11.5
	88.5	88.8 +
	11.5	11.1 +
	1	1

- II. *Prim.* Regular octohedron.
- III. Crystals 100—capillary—amorphous.
- IV, S. G. = 3.95 to 5.691.
- VI. Ferruginous—*Tile ore.*
S. G. = 3.572.—Copper = 10 to 50 per cent.

Species 3. Per-oxide of Copper? — *Black Copper.*

- III. Disseminated—reniform and fibrous.

Species 4. Sulphuret of Copper.—Vitreous copper—copper glance.

	Thom.	Klap.	Klap.	Theory.
i. Copper	73.	76.5	78.5	77.6 | 1
Sulph.	24.5	22.	18.5	19.4 | 1
Iron	1.	.5	2.25	&c.
Silica	1.8	..	.75	
Loss	.2	1.	..	
<i>Or,</i>				
Sulph. Cop.	60.	80.		
Bi-sul. C.	37.5	18.		

ii. *Prim.* Regular hexahedral prism.

iii. Crystals 120.—Amorphous.

iv. S. G. = 4.81 to 5.452.

vi. Variegated vitreous copper.

Purple copper.—*Buntkupfererz.*

	Klap.	Theory.	Klap.	Gueniv.	
Copper	69.5	38.	1	58	74.5 | 47.
Sulph.	19.	19.	1	19	20.5 | 13.
Iron	7.5	&c.		18	1.5 | 9.3
Oxygen	4.			5	.. | 25. Silex
Loss	..			..	3.5 | 7. lime

*Species 5. Bisulphuret of Copper.—Copper
Pyrites.*

	Chen.	Lamp.	Gueniv.
i. Copper	30.	41.	30.
Sulphur	12.	45.1	36.5
Iron		17.1	31.
Zinc .....		..	1.
Ox. Iron	53.	..	..
Silica	5.	..	1.
Loss .....		..	...5
	100.	103.1	100.

Or,

1. Copper	28.	41.	30.
2. Sulp.	14.	20.5	15.
1. Iron		17.1	5.7 +
2. Sulp.		19.5	6.5 +
1. Iron .....		..	25.2 +
1. Sulp. ....		..	14.4 +
1. Zinc .....		..	1.
1. Sulp. ....		..	.4 +
&c.	58.	..	14.5
	100.	98.1	99.7

ii. *Prim.* Regular tetrahedron.

iii. Crystals—concretionary—amorphous.

iv. S. G. = 4.3154.

ix. Mode of extracting the copper—In Cornwall, (1817), 73727 tons of ore yielded 6425 tons of copper.

APPENDIX.

(a) Grey Copper Ore—*Fahlerz*.

	Klaproth		Thoms.	
Copper	41.	48.	42.5	19.2
Iron	22.5	25.5	27.5	51.
Arsenic	24.1	14.	15.6	15.7
Antimony . . . . .	..	..	1.5	..
Silver . . . . .	.4	.5	.9	..
Sulphur	10.	10.	10.	14.1
Loss	2.	2.	2.	..

(b) Black Copper Ore—*Graugiltigerz*.

	Klaproth				
Copper	31.36	37.75	39.	40.25	26.
Iron	3.3	3.25	7.5	13.5	7.
Arsenic . . . . .	..	..	..	.75	..
Antimony	34.09	22.	19.5	23.	27.
Silver	14.77	.25	..	.3	13.25
Sulphur	11.5	28.	26.	18.5	25.5
Zinc . . . . .	..	5.	..	..	..
Mercury . . . . .	..	..	6.25	..	..
Alumina . . . . .	.3	..	..	..	..
Loss	4.68	3.75	1.75	3.7	1.25

(c) Tennantite.

R. Phill.

Copper	45.32
Arsenic	11.84
Iron	9.26
Sulphur	28.74
Silica	5.

Species 6. Sulphate of Copper.—Blue Vitriol.

	Berzelius	Theory.	
I. Per-ox. Copper ..	32.13	32.14	1
Sulph. Acid	31.57	32.14	2
Water	36.30	36.16	10
	<u>100.</u>	<u>100.44</u>	

II. *Prim.* Irregular oblique four-sided prism.

P. M. = $109^{\circ} 32'$, M. T. = $124^{\circ} 2'$

III. Crystals 11.—Concretionary—stalactitic—pulverulent—amorphous.

Species 7. Anhydrous Carbonate of Copper.

	Thoms.	Theory.	
I. Per-ox. Copper ..	60.75	60.74	1
Carbonic Acid ...	16.7	16.71	1
Per. ox. Iron	19.5	&c.	
Silica	2.1		
Loss .....	.95		

IV. S. G. = 2.62.

Species 8. Green Carbonate of Copper—Malachite.

	Fontana	Phill.	Theory.		
I. Per-ox. Copper ..	75.	72.2	72.07	1	
Water	5.6	9.3	8.10	1	
Carb. Acid	19.4	18.5	19.81	1	
	Klap. Proust.	Vauq.	Theory.		
Copper	58.	56.8	56.1	57.65	} 2
Oxygen ..	12.5	14.2	14.	14.41	
Water	11.5	..	8.65	8.10	1
Carb. Acid 18.	27.	21.25	19.81		1
Silica	1.	
Lime	1.	

III. Capillary — fibrous — stalactitic — pseudomorphous—amorphous.

IV. S. G. = 3.5.

Species 9. Blue Carbonate of Copper.

	Phillips	Theory.	
I. Per-ox. Copper	. . 69.08	69.36	3
Carb. Acid	. . . . . 25.46	25.43	4
Water	. . . . . 5.46	5.20	2

Or ?

Green Carb. Copp.	. . 64.14	2
Bi. Carb. Copp.	. . . . 35.83	1

	Vauq. Klap.	Theory.		Pell.
Copper	. . . . 56.	56.	55.26	3
Oxygen	. . . . 12.5	14.	13.81	6
Carb. Acid	. . . . 25.	24.	25.43	4
Water	. . . . . 6.5	6.	5.20	2

II. *Prim.* Irregular octohedron.

III. Crystals—concretionary—earthy.

IV. S. G. = 3.2 to 3.6082.

IX. Turquoise—Armenian stone.

Species 10. Muriate of Copper.

	Berth.	Proust.	
I. Copper	. . . . 52.	46.8	57.4
Oxygen	. . . . 11.	11.5	14.6
Mur. Acid.	. . . . 10.	9.5	10.
Water	. . . . . 12.	15.	12.
Silica	. . . . . 11.	17.	..
Lime	. . . . . . .	..	4.
Iron	. . . . . . . 1.	..	2.

III. Pulverulent.

Species 11. Phosphuret of Copper?

Species 12. Phosphate of Copper.

	Klap.	Theory.
i. Per-oxide Copper....	68.13	68.37
Phosphoric Acid	30.95	23.93
Loss (Water?).....	.92	7.69

	Lunn	Theory.	Quere?	
Per-ox. Cop 18.1	62.847 +	1	18.1	68.31 +
Phos. Acid 6.246	21.687 +		6.246	23.56 +
Water (& } 2.15	15.454 +	2	2.15	8.11 +
Loss).... } 2.304	.....		....	....
	28.8	99.988 +	26.496	99.98 +

ii. *Prim.* Rectangular octohedron.

iii. Crystals 3—fibrous—amorphous.

iv. S. G. = 3.5 to 4.07.

Species 13. Arseniate of Copper.

	Chenevix.						Vauq.		Klap.
I. Per-ox.C.	49	60.	54	50	51	58	59	39	50.62
Ars. Acid	14	39.7	30	29	29	21	41	43	45.
Water	35	....	16	21	18	21	....	17	3.8
Loss.....	....	....	....	....	2	....	....	1	.88
Var.	1	4	3	5	6	2	4	2	4

- III. *Var.* 1. Obtuse octohedral—S. G. = 2.88.
Var. 2. Hexahedral—S. G. = 2.5.
Var. 3. Trihedral—S. G. = 4.2.
Var. 4. Prismatic—S. G. = 4.2—Capillary.
Var. 5. Hæmatitic—*Wood copper*.
Var. 6. Amianthiform.

Species 14. Martial Arseniate of Copper.

Chenev.	
i. Ox. Copper	.....22.5
Arsenic Acid	... 33.5
Ox. Iron	..... 27.5
Water	.....12.
Silica	..... 3.

III. Crystals 2.

Species 15. Bisilicate of Copper?—*Dioptase*—
Crysocolla—*Emerald copper*.

I.	Klap. Theory? Lowitz Theory?		John.					
Copper ...40	40	1	}	55	54.7 +	1	42. 37.8	
Oxygen ...10	10	2					7.63	8.
Silica .....26	20	2	33	32.8 +	3	28.37	29.	
Car. Acid 7	& ^c		....	....		3.	....
Water ....17	....		12	12.3 +	2	17.5	21.8
Sulp. Lime ....	....		....	..		1.5	3.

II. *Prim.* Obtuse rhomboid P. P' = 126° 17'.

III. Crystals.

IV. S. G. = 3.3.

Species 16. Seleniuret of Copper?

GENUS XII. LEAD.

S. G. = 11.352—Minium—Massicot—Litharge—
Ceruse—Use in glass.

Species 1. Native Lead.

Species 2. Protoxide of Lead?—*Native massicot.*

	John.	Theory.
i. Lead.....	82.6923	Protox. Lead 30.486
Oxygen	10.5768	Per-ox. Lead 41.803
Carb. Acid ...	3.8462	Carb. Lead ... 24.825
Ox. Iron } and Lime }	.4808	&c..... .. 2.884
Copper.....	trace	
Ferruginous } Silica }	2.4039	

iii. Amorphous.

iv. S. G. = 8.

Species 3. Per-oxide of Lead—*Native
Minium.*

iii. Pulverulent—amorphous.

Species 4. Sulphuret of Lead—Galena.

I.	Vauq.	Theory.	Westr.	Theory.	Thoms.	Theory.
Lead . 54	53.7 +	83.00	86.18 +	85.13	85.08 +	1
Sulph. 8	8.2 +	16.41	13.22 +	13.02	13.06 +	1
Silic. } 38	&c.	&c.		&c.		
Lime }						

	Vauquelin.				Meade.	
Lead	69.	69.	68.	64.	72.	
Sulphur . .	16.	18.	16.	18.	24.	
Lime & } Silica . . }	15.	13.	16.	18.	4.	
Lead	65.	66.5 +	64.2 +	62.9 +	73.4 +	1
Sulphur . .	20.	20.4 +	19.7 +	19.0 +	22.5 +	2
						Theory.

ii. *Prim. Cube.*

iii. Crystals—granular—amorphous.

Specular (*Slickensides.*)

iv. S. G. = 7.5873.

vi. Antimoniferous—16 to 28 per cent. of Antimony.

Argentiferous— $11\frac{1}{2}$ oz. to 135. oz. of silver per ton.

Ferriferous.

Supersulphuret.

Blue-Lead; pseudomorphous; S. G. = 5.4.

ix. Usual ore of lead—glaze for pottery.

Species 5. Sulphate of Lead.

	Klapr.	Theory.	Klapr.	Theory.	
I. Ox. Lead..	71.	71.	70.5	70.5	1
Sulp. Acid.	24.8	23.6 +	25.75	23.5	1
Water	2.	&c.	2.25	&c.	
Ox. Iron . .	1.				
Loss	1.2				

II. *Prim.* Rectangular octohedron.

III. Crystals 8—granular—amorphous.

IV. S. G. = 6.3.

Species 6. Carbonate of Lead.

	Westrumb.		Theory.	Lampad.	Theory.	
I.						
Ox. Lead. .	80.25	81.2	81 2	78.5	78.5	1
Carb. Acid.	16.	16.	15.72	18.	14.3	1
Ox. Iron . .	.18	.3	&c.	..	&c.	
Alumina . .	.75	..		..
Lime . . . .	.5	.9		..		
Water . . . .	..	..		2.		
Charcoal . .	..	..		1.5		
Loss	2.32	1.6		..		

II. *Prim.* Rectangular octohedron P. P' = 108° 20'.

M. M' = 117° 18'.

III. Crystals—acicular—earthy—amorphous.

IV. S. G. = 6.0717 to 6.72.

VI. Cupriferos.

Species 7. Muriate of Lead—Murio-carbonate of Lead.

	Klap.	Theory.	Klap.	Chen.
I. Ox. Lead . . . . .	.55	61.5 +	1	85.5
Mur. Acid . . . . .	.45	38.4 +	2	8.5
Carb. Acid . . . . .	..			6.
Loss				1.

III. Crystals 4.

IV. S. G. = 6.0651.

Species 8. Phosphate of Lead.

I.	Klap.	Theory.	Four.	Klap.	Vauq.	Langier.
Ox. Lead . . . . .	.80.	79.4 +	1	79	78.4	49.23
Phos. Acid . . . . .	.18.	18.5 +	1	18	18.37	18.17
Ox. Iron		&c.		1	1.	..
Mur. Acid	1.6			..	1.7	..
Water				2	..	..
Silica . . . . .					..	32.
Loss . . . . .					..	..
						76.8
						9.
						1.5
						4. ars.
						7.
						1.7

II. *Prim.* Obtuse rhomboid P. P. = 110° 55'.

III. Crystals—mamillary—amorphous.

IV. S. G. = 6.4 to 6.9411.

VI. Arseniated.

Species 9. Arseniate of Lead.

	Gregor.	Theory.	Rose.
I. Ars. Acid	26.4	26.4	1
Ox. Lead	69.76	54.61 +	1
.....	.....	5.11 +	} &c.
Mur. Acid	1.58	1.58	
Ox. Iron	} 2.26	} &c.	
Silica, &c.			
			19.05
			73.13

III. Crystals—capillary—mamillary—amorphous.

IV. S. G. = 5.0466 to 6.4.

VI. Reniform—S. G. = 3.9.

	Bindheim	Theory.
Ox. Lead....	25.	Arsenate of Lead 37.0 +
Ox. Iron	14.	Arsenate of Iron 22.6 +
Ars. Acid....	25.	Perox. Iron..... 4.2 +
Silver	1.15	&c.....
Silica	7.	
Alumina	2.	
Water	10.	

Species 10. Molybdate of Lead.

I.	Klap.	Theory.	Macq.	Theory.	Hatch.
Ox. Lead	64.62	64.35	58.75	56.57 +	1 || 58.4
Molyb. Acid	34.25	34.32	28.	30.17 +	1 || 38.
Loss	1.33	&c.	&c.		&c.

II. *Prim.* Symetrical octohedron P. P'. = 76° 40'.

III. Crystals 10—amorphous.

IV. S. G. = 5.09 to 5.48.

Species 11. Chromate of Lead.

I.	Vauq.	Then.	Theory.
Ox. Lead....	63.96	65.1	64. | 69.7 + | 1 |
Chr. Acid....	36.4	34.9	36. | 30 2 + | 1 |

II. *Prim.* Oblique rhomboidal prism.

III. Crystals—lamelliform.

IV. S. G. = 5.75 to 6.

Species 12. Chromite of Lead?

GENUS XIII. ZINC.

S. G. = 7.19.—Malleable and ductile, between 210^d and 300^d Fahr.—Flowers of Zinc—Brass—Princes metal—Pinchbeck—Tombac.

Species 1. Oxide of Zinc—Red Zinc Ore.

Bruce. Theory.

I. Zinc	....76	74.7 +	1
Oxygen	....16	17.2 +	1
Ox. Iron & } Ox. Mang. }	8	&c.	

III. Disseminated—amorphous.

IV. S. G. = 6.22.

Species 2. Sulphuret of Zinc—Blende.

I. *Yellow.*

	Berg. Hecht.	
Zinc	64	62
Sulph.	20	21
Iron	5	3
Flu. Ac.	4	....
Silica	1	24
Water	6	5
Alum.	....	5
Loss	....	2
Oxide of Zinc	44 5	60.4
Sulphur	16.4	22.5

Brown.

	Thom.	Theory?		Thom.
Zinc	58.8	Ox. Zinc	59.9 + 1	58.64
Sulp. ..	23.5	Sulphur	22.3 + 1	28.64
Iron	8.4	&c.		11.96
Silica	7.			.76
Loss	2.			

Black.

	Berg.	Theory.	Lamp.	Berg.
Zinc	52.	53.5 + 1	53.	45
Sulp.	26.	24.4 + 1	26.	29
Iron	8.	&c.	12.	9
Silica	6.		....	4
Water	4.		4.	6
Loss	4.		5.	6

II. *Prim.* Rhomboidal dodecahedron.

III. Crystals 50.—Concretionary—amorphous.

IV. S. G. = 4.1665.

IX. White vitriol.

Species 3. Carbonate of Zinc—Calamine.

	Smithson		Theory.	Smit. Theory.		
I. Ox. Zinc. . .	65.2	64.8	66.1 + 1	69	54	1
Car. Acid . .	34.8	35.2	33.8 + 1	28	28	1
Iron .....	..	..	....	1	&c.	

II. *Prim.* Obtuse rhomboid.

III. Crystals — Earthy — pseudomorphous — amorphous.

IV. S. G. = 4.3.

IX. Usual ore for Zinc.

Species 4. Silicate of Zinc—*Electric Calamine.*

	Klap. Theory.	Smiths. Theory.	John. Theory.	
Ox. Zinc	66.66	68.	67.7 +	69.25 | 69.25 | 1
Silica	...33.24.5 +	25.	25.2 +	30.75 | 25.76 + | 1
...	8.4 +	...	&c.	... | 4.98 +
Water	...	4.4	...	...
Loss	...	2.3	...	...

II. *Prim.* Rectangular octohedron.

III. Crystals 20. — Concretionary — stalactitic — amorphous.

IV. S. G. = 3.4.

GENUS XIV. ANTIMONY.

Printing types—optical mirrors.

Species 1. Native Antimony.

II. *Prim.* Regular octohedron.

III. Crystals (artificially formed) 3.—Disseminated —amorphous.

IV. S. G. = 6.7021 to 6.72.

VI. Argentiferous Antimony—silver 1 per cent.

Arsenical Antimony—arsenic 2 to 16 per cent.

Cupriferos Antimony.		Nickeliferos Antimony.	
	Theory.		Vauq.
Antimony	..70	70.	Antimony ...50
Copper	...20	19.33	Nickel .....25
Sulphur	... 9	9.66	Arsenic....
Arsenic	... 1	1	Sulphur ... } 25
			Iron }
			Lead }

Species 2. Oxide of Antimony.—White Antimony.

III. Tabular — acicular — capillary — earthy — amorphous.

VI. Ferro-plumbiferous.

		Theory.	
Antimony ..34	34.	}	Ox. Antim..40.04 +
Oxygen ...16	18.61 +		Per-ox. Iron 34.57 +
Iron .....22	22		Sulp. Lead .13.84 +
Lead .....12	12	}	Silica .....14.
Sulphur ... 2	.84 +		<u>102.45 +</u>
Silica ....14	14		
	<u>100</u>	<u>102.45 +</u>	

IX. Colour for porcelain—pastes and enamels—medical properties of the two oxides.

Species 3. Sulphuret of Antimony.—Grey Antimony.

Proust J. Davy Berg. Theory.

I. Antim..	75.1	74.06	74	73.77 +	1
Sulp....	24.9	25.94	26	26.22 +	1

II. *Prim.* Rhomboidal octohedron.

III. Crystals 20.—Acicular—capillary—amorphous.

IV. S. G. = 4.1327 to 4.5165.

VI. Argentiferous — auriferous — with crystals of sulphur.

With native Antimony?

Antimony ..78.3	19.2	native.	}
Sulphur ....19.7	59.1	} sulphuret.	
	19.7		

IX. Methods of extracting the metal—uses in the East.

*Species 4. Sulphuretted Oxide of Antimony.—
Red Antimony—Kermes Mineral.*

	Klap.	Theory.	
I. Antimony ..67.5	65.21 +	}	1
Oxygen ...10.8	23.18 +		
Sulphur ...19.7	11.59 +		

III. Acicular—amorphous.

IV. S. G. = 4.09.

*Species 5? Bournonite.—Endellione—Triple
Sulphuret of Lead.*

	Hatchet	Theory.
Antimony..24.23	24.23	Sulp. Ant. .32.84 + Sulp. Lead 49.17 + Sulp. Cop. .16. Sulp. Iron.. 1.88 + <hr style="width: 100%;"/> 99.89 + <hr style="width: 100%;"/> ∴ mean error = .40 +
Lead .....42.62	42.62	
Copper ...12.8	12.8	
Iron 1.2	1.2	
Sulphur ...17.	19.04 +	
	97.85 99.89 +	

III. Crystals.

IV. S. G. = 5.7.

GENUS XV. SILVER.

S. G. = 10.47 to 10.51—Leaf Silver = $\frac{1}{160000}$ inch thick.—Wire $\frac{1}{10}$ inch supports 370 lbs.—Alloy of commerce, Silver : Copper :: 137 : 7 and S. G. less than the mean by .1264—fulminating compounds—Arbor Dianæ—indelible ink.

Species 1. Native Silver.

II. *Prim.* Cube.

III. Crystals 3.—Granular—amorphous.

IV. S. G. = 10 to 10.338.

VI. Purest is alloyed with .03 of other metals.—

Auriferous—Silver. .36 to 72 } per cent.
Gold .64 to 28 }

Species 2. Sulphuret of Silver.—Vitreous Silver.

Klaproth Theory.

I. Silver . . . . .	.75 to 85	77.46 +	| 1 |
Sulphur . . . . .	.25 to 15	22.53 +	| 2 |

II. *Prim.* Cube.

III. Crystals 3.—Amorphous.

IV. S. G. = 6.9099 to 7.215.

VI. Black silver—brittle sulphuretted silver—white silver—Bismuthic silver.

Arsenical sulphuretted Silver.

Berg. Theory.		Proust.	
Sulphur ...	13	13.	2
Silver	60	44.86 +	1
.....	..	15.13 +	1
Arsenic ...	27	27.	1

			2
Sulp. Silver ..	74.35		1
Sulp. Ars.....	25.		1
Sulphur and }	..65		1
Ox. Iron ... }			1

ix. Ancient medals.

Species 3. Carbonate of Silver.

Selb		Theory.	
I. Silver .....	..	4.5	| . |
Per-ox. Sil...	72.5	68. }	| 1 |
Carb. Acid ..	12.	12. }	| 1 |
Carb. Ant....	15.5	15.5	| . |

Species 4. Muriate of Silver—*Horn Silver.*

Klap.		Theory.		Klap.		Theory.	
I. Silver ...	76.	27.24 +	|	67.75	23.89 +	|	|
.....	..	48.75 +	1	..	43.85 +	1	1
Oxygen	7.6	7.09 +	2	6.75	6.37 +	2	2
Mur. Acid	16.4	16.4	1	14.75	14.75	1	1
Ox. Iron	..	....		6.			
Sulp. Acid	..	....		...25	&c.		
Alumina .	..	....		1.75			

ii. *Prim.* Cube ?

iii. Crystal 1.—Acicular—investing—amorphous.

iv. S. G. = 4.745 to 4.8.

Species 5. Antimonial Silver.

	Abich	Klap.	Theory.
i. Silver	.75.25	76 to 84	70.6 + | 1 |
Antim...	24.75	24 to 16	29.3 + | 1 |

iii. Crystals—Plumose—granular—amorphous.

iv. S. G. = 9.4406 to 10.

*Species 6. Arsenical Silver?**Species 7. Red Silver—Ruby Silver.—Sulphuret of Antimonial Silver?*

	Lamp.	Klaproth			Theory.
i. Silver	.61.	62.	60.	60	56.4 + | 1 |
Oxygen	4.2	5.1	5.	4	4.1 + | 1 |
Antim...	19.	18.5	20.3	19	23.0 + | 1 |
Sulp. . .	13.3	14.4	14.7	17	16.4 + | 2 |

	Then.	Vauq.	Lamp.
Silver	.58.	56.67	54.27
Oxygen	..	12.13	11.85
Antim...	23.5	16.13	16.13
Sulp. . .	16.	15.07	17.75
Loss...	2.5	..	..

ii. *Prim.* Obtuse rhomboid P. P' = 109° 28'.

iii. Crystals—Dendritic—disseminated—amorphous.

iv. S. G. = 5.5637 to 5.5886.

GENUS XVI. MERCURY.

S. G. of solid = 14.176 to 14.465—S. G. of fluid = 13.568.

Condensation = $\frac{1}{23}$ of its volume.

Impurities in the mercury of commerce—use in gilding—silvering—mirrors—barometer—thermometer.

Species 1. Native Mercury—*Quicksilver.*

III. Liquid.

IV. S. G. = 13.581 to 13.6.

Species 2. Sulphuret of Mercury—*Cinnabar.*

	Sage	Klap.		Theory.	
I. Mercury	..30	84.5	85.	86.20 +	1
Sulphur	..20	14.75	14.25	13.79 +	2
	Lamp.	Theory.			
Mercury	..81:	81.	}	1	}
Sulphur	..15.2}	12.96	}	2	}
.....	..	2.24	}		
Iron	..... 4.7	3.808	}		

II. *Prim.* Acute rhomboid.

III. Crystals 2. — Granular — pulverulent — amorphous.

iv. S. G. = 6.9 to 10.871.

vi. Hepatic Cinnabar—S. G. = 7.1 to 7.186.

	Klap.	Theory.		
Mercury	81.8	81.8	1	
Sulphur	13.75	13.2	2	
.....	.....	.55		
Copper . . . . .	.02	&c.		
Ox. Iron . . . .	.2			
Alumina . . . .	.55			
Silica . . . . .	.65			
Carbon	2.3			
Loss . . . . .	.73			

Bituminous Cinnabar.

*Species 3. Muriate of Mercury—Horn
Quicksilver.*

	Klap.	Theory.	Klap.	Theory.		
i. Mercury	76.	29.9	67.75	5.7		
.....	..	46.09	..	61.2	1	
Mur. Acid ..	16.4	16.4	21.	21.	2	
Sulp. Acid ...	7.6		..	&c.		
Iron . . . . .	..		6.			
Alumina . . . .	..		...5			
Lime . . . . .	..		...25			
Loss . . . . .	..		4.25			

	Berg.	Theory.	Berg.	Theory.
Ox. Mercury. .70	67.0 +	75.	74.1 +	1
Mur. Acid.20	23.9 +	24.5	25.3 +	2

iii. Crystal 1.—Amorphous—tubercular crusts.

*Species 4. Argental Mercury—Native Amalgam
—Silver Amalgam.*

	Klap.	Theory.	Cordier	Theory.	
I. Silver	36	35.4 +	|| 27.5	| 27.5	| 1
Mercury	64	64.5 +	|| 72.5	| 50.	| 1
II. <i>Prim.</i> Regular octohedron?					
III. Crystals 4.					
IV. S. G. = 10. to 14.1192.					

GENUS XVII. BISMUTH.

S. G. = 9.8227—Easy method of obtaining it crystallized—

Bism. : gold :: 1000 : 1	}	Alloys.
Bism. : lead : tin :: 8 : 5 : 3		
Bism. : lead : tin : mercury :: 8 : 5 : 3 : 1		
Bism. : lead : tin : mercury :: 2 : 1 : 1 : 4		

Pearl white — Mosaic silver — pewter — solder — printing types.

Species 1. Native Bismuth.

- II. *Prim.* Regular octohedron.
- III. Crystals 2—feathery—reticulated—amorphous.
- IV. S. G. = 9.02 to 9.57.

Species 2. Oxide of Bismuth—Bismuth Ochre.

- III. Disseminated—amorphous.
- IV. S. G. = 4.7.

Species 3. Carbonate of Bismuth.

- III. Amorphous.

Species 4. Sulphuret of Bismuth.

I. Lagerh. J. Davy.

Bismuth. .81.25	| 81.7	| 1	} Theory for the artificial.
Sulphur . .18.75	| 18.3	| 1	

Sage. Klap. Theory.

Bismuth. .60	| 60	| 68.9 +	| 1
Sulphur . .40	| 39	| 31.0 +	| 2

III. Acicular—capillary—amorphous.

IV. S. G. = 6.131 to 6.4672.

VI. Cupriferous.

Klap.

Theory.

Bismuth. .47.24	| 47.24	| Sulph. B. . .57.89 +
Copper . .34.66	| 34.66	| Sulph. C. . .43.32 +
Sulphur . .12.58	| 19.31	| &c.
Loss 5.52	| &c.	

Or?

Bismuth.	40.34 +	|
Bisulph. Bis.	10.80 +	|
Sulp. Cop.	43.32 +	|
&c.		

Plumbo-cupreous.

Argentiferous (*needle ore.*)

	John.	
Bismuth	43.20	Bismuth27.
Lead	24.32	Sulphur16.3
Copper	12.10	Silver15.
Sulphur	11.58	Lead.33.
Gold	0.79	Copper9
Nickel.	1.58	Iron 4.3
Tellurium	1.32	Loss 3.5
Loss of Oxy- } genated Sulp. }	5.11	

GENUS XVIII. COBALT.

S. G. = 8.5384—Alloy of Cobalt : Gold :: 1 : 65
 —Zaffre and Smalt—imitation of sapphire,
 lapis-lazuli, &c.—Sympathetic inks, blue, red,
 and green.

Species 1. Per-oxide of Cobalt—*Earthy
 Cobalt.*

Proust. Theory.

i. Cobalt.....	74	| 74.14	| 1
Oxygen	26	| 25.86	| 2

iii. Concretionary—pulverulent—amorphous.

iv. S. G. = 2. to 2.5—and 3.509?

Species 2. Bi-sulphuret of Cobalt—*Cobalt
 Pyrites.*

Hising.

Theory.

i. Cobalt ..	43.2	43.2	} Bisulp. Cob. ..73.33 Bisulp. Cop. ..21.6 Bisulp. Iron .. 5.56 &c.
Sulphur .	38.5	39.36	
Copper .	14.4	14.4	
Iron....	3.53	3.53	
Silex ..	.33	.33	
	<hr/>	<hr/>	
	99.96	100.82	
	<hr/>	<hr/>	

Species 3. Sulphate of Cobalt—Red Vitriol.

Koppe. Theory.

i. Ox. Cobalt.	38.71	34.83 +	1
Sulp. Acid	19.74	23.61 +	1
Water	41.55		

ii. Investing—stalactitic.

Species 4. Arsenical Cobalt.

i. Arsenic	49.4 +	} Theory.
Cobalt	50.5 +	

ii. *Prim.* Cube.

iii. Crystals—reticulated—concretionary—amorphous.

vi. *Var. 1.* Bright white Cobalt—*Cobalt glance.*

Klap. Theory. Tassaërt Theory.

Arsenic	55.5	12.5 +	49.	14.89 +	1
.....		42.9 +	....	34.10 +	
Cobalt	44.	44.	36.66	36.66	1
Sulphur	.5	&c.	6.5	&c.	
Iron	.....	...	5.66		
Loss	.....	....	2.18		

S. G. = 4.9411 to 6.466.

Var. 2. Grey Cobalt.

Klap. Theory.

Arsenic	33	13.4 +	1
.....		19.5 +	
Cobalt	20	20	1
Iron	24	&c.	
Bismuth	} 23		
Earth, &c.			

Var. 3. Tin white Cobalt.

	John.	Laugier.	
Arsenic	65.75	50.	68.5
Cobalt	28.	12.7	9.6
Iron	5.	10.5	9.7
Mangan.	1.25	..	..
Sulphur . . . . .	..	..	7.
Silex . . . . .	..	25.	1.
Loss . . . . .	..	..	4.2

S. G. = 7.379 to 7.751.

Species 5. Arseniate of Cobalt—Red Cobalt.

	Buch.	Theory.	
i. Cobalt	39	38.1 +	1
Ars. Acid	38	38.8 +	1
Water	23		

iii. Acicular—pulverulent—investing.

GENUS XIX. GOLD.

S. G. = 19.2572 to 19.36—One grain may = 500 ft. in length, and can be extended over 56 square inches—Wire $\frac{1}{10}$ inch supports 500 lbs.—Standard, Gold : silver } :: 11 : 1—Green gold, Gold : copper }
: silver :: 4 : 1.

Gilding—colours for glass—purple powder of Cassius.

Species I. Native Gold.II. *Prim.* Cube?III. Crystals—capillary—ramose—pulverulent—
amorphous.

IV. S. G. = 17. to 19.

VI. Argentiferous—Gold 64 to 93.5 } per cent.
Silver 36 to 6. }

IX. Amalgamation and Cupellation.

GENUS XX. PLATINUM.

S. G. = 20.847 to 20.98 and 23.—Wire, diameter =
 $\frac{1}{5000}$ (and $\frac{1}{30000}$?) of an inch.*Species* I. Native Platinum—*Platina*.

III. Crystal—In grains, some = 2 inches cubed.

IV. S. G. = 15.6017 to 19.5.

VI. Alloyed with Iron, Iridium, Osmium, &c. &c.

GENUS XXI. PALLADIUM.

Species I. Native Palladium.

III. In grains.

IV. S. G. = 10.9 to 11.8.

VI. Alloyed with Platina, Gold, Iridium.

GENUS XXII. TELLURIUM.

S. G. = 6.11.

Species 1. Native Tellurium.

	Klaproth.	purest	graphic yellow	black	
i. Tellurium.....	92.55	60	44.75	32.2	33.
Gold .....	.25	30	26.75	9.	8.5
Silver		11	8.5	0.5	0.5
Lead .....		..	19.5	54.	50.
Copper .....		...	...	1.3	0.5
Iron	7.2	...	...	...	...
Sulphur .....		..	0.5	3.	7.5
iv. Spec. Grav. 5.7 to 6.1	5.7	10.6	8.919		

ii. *Prim.* Rectangular prism.

iii. Crystals 20.

GENUS XXIII. URANIUM.

S. G. = 6.44.

Species 1. Oxide of Uranium?—*Uran-ochre*
—*Pitchblende.*

	Lampad.	Klap.	Sage.
i. Ox. Uran.....	32.	86.5	78.
Silica.....	56.	5.	..
Alumina	3.5	..	..
Iron.....	7.5	2.5	20.
Sulphur.....	..	..	2.
Sulph. Lead .....	..	6.	..
Loss	1.	..	..

- III. Globular—pulverulent—amorphous.
- IV. S. G. = 7.575.

*Species 2. Phosphate of Uranium—Uranite
—Uran-mica.*

I. Gregor R. Phill. Theory.

Ox. Uran. .74.4	60.	Ox. Uran....60.	1
Phos. Acid. . .	16.	Phos. Acid....12.	1
Ox. Copper 8.2	9.	Water 7.7	2
Water . . .15.4	14.5	Ox. Copper . 9.	1
Loss 2.	..	Phos. Acid.... 3.9 +	1
		Water 2.5 +	2
		Water 4.2	

- II. *Prim.* Right symetrical prism.
- III. Crystals—pulverulent.
- IV. S. G. = 2.19 to 3.25.

GENUS XXIV. TITANIUM.

*Species 1. Oxide of Titanium—Titanite—
Rutil.*

- II. *Prim.* Right symetrical prism.
 - III. Crystals 2—acicular—fibrous (*hairs of Venus*)
—pulverulent.
 - IV. S. G. = 4.18 to 4.24.
 - VI. Nigrine; S. G. = 4.4.
- | | | |
|-----------------------|---|-----------|
| Ox. Titan.....84. | } | Klaproth. |
| Ox. Iron14. | | |
| Ox. Mang. 2. | | |

Menaccanite; S. G. = 4.4.

Ox. Titan.....	45.25	}	Klaproth.
Ox. Iron	51.		
Ox. Mang.....	.25		
Silica	3.5		

Iserine.

Ox. Titan.....	48.	}	Thomson.
Ox. Iron	48.		
Ox. Uran.....	4.		

Species 2. Anatase; Octohedrite.

II. *Prim.* Symetrical octohedron P. P'. = 125° 47'.

III. Crystals 4.

IV. S. G. = 3.85.

Species 3. Spkene.

Klap. Cordier. Klap. Abild.

I. Ox. Titan..	33.	33.3	45	74	58
Silica.....	35.	28.	36	8	22
Lime.....	33.	32.2	16	18	20
Water .....	..	..	1	..	..
Loss ... .. .	..	6.5	..	..	..

II. *Prim.* Rhomboidal octohedron, P.P'. = 131° 16'.

III. Crystals—amorphous.

IV. S. G. = 3.23 to 4.24.

GENUS XXV. CERIUM.

*Species 1. Silicate of Cerium?**Var. 1. Cerite.*

I.	Hisinger.	John.	Theory?	Vauq.
Ox. Cerium..	68.59	71.4	69.75	63.
Silica	18.	18.	18.	17.5
Ox. Iron	2.	5.25	&c.	2.
Copper.....	..	.35		..
Lime	1.25	..		4.
Water.....	9.6	4.		12.

	Hisin.	Klap.	Thoms.
Ox. Cerium ..	50.	54.5	44.
Silica	23.	34.5	47.3
Ox. Iron	22.	3.5	4.
Lime.....	5.5	1.25	....
Water .....	..	5.	3.
Loss .....	..	....	1.7

iii. Amorphous.

iv. S. G. = 4.53 to 4.93.

Var. 2. Allanite—Cerin.

	Thoms.	Berz.	Wollast.
i. Ox. Cerium ..	33.9	28.19	19.8
Silica	35.4	30.17	34.
Ox. Copper .....	..	.87	..
Ox. Iron	25.4	20.72	32.
Alumina	4.1	11.31	9.
Lime	9.2	9.12	..
Water	4.	..	..
Loss	12.	..	..

III. Crystals?—amorphous.

IV. S. G. = 3.1 to 3.4.

Var. 3. Orthite.

i. Ox. Cerium....	17.39	19.44	} Berzelius.
Silica	36.25	32.	
Ox. Iron	11.42	12.44	
Ox. Mang.	1.36	3.4	
Alumina	14.89	14.8	
Lime	4.89	7.84	
Yttria	3.8	3.44	
Water	8.7	5.36	

III. Amorphous.

VI. Pyrorthite; Carbon = 25 per cent.

Species 2. Fluates of Cerium?

Var. 1. Sub-fluate of Cerium.

III. Amorphous.

Var. 2. Neutral Fluates, or Deuto-fluates of Cerium.

III. Six-sided prism—amorphous.

Var. 3. Double Fluates of Cerium and Yttria.

III. Amorphous.

Var. 4. Yttrocerite.

III. Amorphous.

IV. S. G. = 3.447.

GENUS XXVI. COLUMBIUM—*TANTALIUM*.

Species 1. Oxide of Columbium.—*Columbite*
—*Tantalite*.

III. Crystals—amorphous.

IV. S. G. = 5.87 to 7.95.

Species 2. Ytthro-columbite—*Ytthro-tantalite*.

Berzelius.			
	}		
I. Ox. Columb....	57.	60.12	51.81
Yttria	20.25	29.78	38.51
Ox. Iron	3.5	1.15	.55
Ox. Uran.....	.5	6.62	1.11
Lime	6.25	.5	3.26
Tung. Acid....	8.25	1.04	2.59

III. Crystals?—amorphous.

IV. S. G. = 5.13 to 5.88.

GENUS XXVII. IRIDIUM.

Species 1. Alloy of Iridium and Osmium.

III. Crystals 2.—In grains.

IV. S. G. = 19.5.

OSMIUM.

RHODIUM.

CADMIUM.

GENUS XXVIII. POTASSIUM.

Potash—Hydrate of Potash.

Species 1. Sulphate of Potash.

I. Artificial. Wollas. Kirwan. Berz. Berard. Berth. Theory.

Hyd. Potash	54.2	54.8	55	57.24	58.5	58.76	1
Sul. Acid ...	45.8	45.2	45	42.76	41.5	41.23	1

II. *Prim.* Acute rhomboid P. P'. = 87° 48'.

III. Crystals 2—amorphous.

Species 2. Nitrate of Potash.—*Nitre*—*Saltpetre*.

Klap. Theory.

i. Hyd. Potash....	19.85	19.85	1
Nit. Acid	22.75	18.8	1
Lime	27.	&c.	
Carb. Acid	13.4		
Loss.....	1.4		

II. *Prim.* Rectangular octohedron P.P'. = 111° 14'.

M. M'. = 120°.

III. Crystals 7—acicular—fibrous—incrusting.

GENUS XXIX. SODIUM.

Soda—Hydrate of Soda—Manufacture of Glass.

Species 1. Sulphate of Soda—*Glauber's Salt*.

I. Artificial. Woll. Berard. Theory.

Hyd. Soda. .44	47.22	49.3 +	1
Sulph. Acid. .56	52.78	50.6 +	1

- II. *Prim.* Symmetrical octohedron P. P'. = 100°.
 III. Crystals 2—pulverulent—incrusting.

Species 2. Bi-carbonate of Soda—*Natron*—*Trona*.

	Klap.	Theory.		
I. Hyd. Soda.....	37.	36.17 +	1	|
Carb. Acid	38.	38.82 +	2	
Water	22.5	&c.		
Sulp. Soda.....	2.5			

- II. *Prim.* rhomboidal octohedron P. P'. = 78° 28' ?
 III. Crystals?—fibrous—amorphous.
 VIII. Recent formation in Stoke church, N. Devon.

Species 3. Borate of Soda—*Borax*—*Tincal*.

	Klap.	Berg.	Theory.		
I. Hyd-Soda....	14.5	17	16.77	1	|
Bor. Acid....	37.	36	36.	4	
Water	47.	47	&c.		
Loss	1.5	..			

- II. *Prim.* Oblique rectangular prism; P. M. = 106° 7'.
 III. Crystals 5—amorphous.

Species 4. Muriate of Soda—*Salt*.

I. Artificial.	Berard.	Berzelius.		Marc. Kirw.	Theory.		
Hyd. Soda ..	57	54.26	53.44	54	53	52.56 +	1
Mur. Acid ..	43	45.74	46.55	46	47	47.43 +	1

Fossil.	Berg. Theory.	Berg. Theory.		
Hyd. Soda ..42	42.	50	40.1	1
Mur. Acid ..52	34.5	33	33.	1
Water..... 6	..	17	..	..

II. *Prim.* Cube.

III. Crystals—capillary—fibrous—amorphous.

IV. S. G. = 2.54.

VIII. Brine springs and salt lakes.

Species 5. Nitrate of Soda.

II. *Prim.* Obtuse rhomboid P. P'. = 106° 16'.

III. Amorphous.

IV. S. G. = 2.0964.

GENUS XXX. AMMONIUM?

Ammonia.

Species 1. Sulphate of Ammonia.

	Kirwan Theory.		Phil. Theory.		
I. Ammonia. .29.7	25.7 +	1	40	36.9	2
Sulp. Acid 55.7	60.6 +	1	42	43.4	1
Water 14:16	13.6	1	18	19.5	2
Loss..... .44	..		..

III. Crystal 1—concretionary—pulverulent.

Species 2. Muriate of Ammonia—*Sal Ammoniac.*

	Klap.		Theories.			
I. Ammonia	31.4	32.0	25. +	1	38.2	2
Mur. Acid	49.5	50.73	58. +	1	41.5	1
Water	16.6	17.	14. +	1	20.2	2
Sulphate of } Ammonia }	2.5	....			
Soda	.....	.27				

II. *Prim.* Regular octohedron.

III. Crystals 3—plumose — concretionary — amorphous.

GENUS XXXI. CALCIUM.

Lime—Hydrate of Lime.

Species 1. Carbonate of Lime—*Iceland Spar.*

I.	Berg.	Vauq.	Biot.	Holmes	Theory.
Lime	55.	57.	56.351	55.9375	56.862 + 1
Carb. Acid	34.	43.	42.919	44.0625	43.137 + 1
Water	11.	..	.73	....	....

II. *Prim.* Obtuse rhomboid P. P' = 105° 5'.

III. Crystals 300.

Foliated (*Schiefer spar*)—fibrous (*Satin-spar.*)

Granular limestone (*statuary marbles*)—Parian
—Thasian—Naxian—Pentelican—Carrara
—Cipolino.

Earthy carbonate of lime—incrustations; mode of deposition.

Stalactites—Theory of their formation—Alabaster.

Compact limestone (*secondary marbles*)—Lumacella — Cotham — Carinthia — Ruin marble—Madreporite — Ludus Helmontii—Swinestone—Bituminous limestone—Argillo-ferruginous limestone (*Calp*)—Pisolite — Oolite—Chalk—Agaric mineral—Aphrite—Tufa—Marl.

iv. S. G. of crystals = 2.69 to 2.7.

S. G. of the compact varieties = 2.3 to 2.8.

vi. Fontainebleau spar ; S. G. = 3.6.

	Sage.	Theory.
Lime	18.5	18.7 + 1
Carb. Acid	14.5	14.2 + 1
Sand	67.	. . . . .

∴ Atoms of Silica : Atoms of Carb. Lime, in a greater ratio than 6 : 1.

ix. Architecture — statuary — mortar — agriculture — lithography — drawing chalks — whiting — casts made at St. Philip in Tuscany.

Species 2. Arragonite—*Hard calcareous spar.*

	Fourc.	Biot.	Holmes	Theory.
i. Lime	58.5	56.327	55.8	56.862 + 1
Carb. Acid	41.5	43.045	43.4	43.137 + 1
Water . . . . .	. . . . .	0.628	0.8	. . . . .

ii. *Prim.*, Rectangular octohedron P.P. = 109° 28'.

- III. Crystals—Fibrous—coralloidal (*flos-ferri*)—stalactitic—amorphous.
- IV. S. G. = 2.9267.

Species 3. Sulphate of Lime—Selenite.

	War.	Bucholtz.	Phil.	Bert.	Theory.		
I. Lime	32	33.9	33.	32.7	32.8	33.3	1
Sulp. Acid 47		43.9	43.5	46.3	45.2	45.9	1
Water	21	21.	21.	21.	22.	20.6	2
Loss		1.2	2.5	..	..	..

- II. *Prim.* Right irregular quadrangular prism.
- III. Crystals 10—Lenticular—acicular—fibrous—granular (*gypsous alabaster*)—compact (*gypsum*)—earthy.
- IV. S. G. = 2.2642 to 2.3117.
- VI. Calciferous; carbonate lime = .012 per cent.
- IX. Statuary—vases, &c.—ancient lacrymatories—Temple of Seia—Plaster of Paris—agriculture.

Species 4. Anhydrous Sulphate of Lime—Anhydrite—Muriacite.

	Vauq.	Klaproth.	Theory.		
I. Lime	40.	42.	42.	42.0 +	1
Sul. Acid	60.	56.5	57.	57.9 +	1
Silex . . . . .	..	..	.25	....
Soda . . . . .	..	.25	..	....
Ox. Iron . . . . .	..	..	1.	....

- II. *Prim.* Right rectangular prism.
 III. Crystals 3—fibrous—amorphous.
 IV. S. G. = 2.5 to 2.9.
 VI. Siliciferous (*vulpinite*); Silica = 8 per cent.
 IX. Used as a marble.

Species 5. Nitrate of Lime.

Berg. Kirwan. Theory.

I. Lime	32	32.	31.4 +	1	} Artificial.
Nit. Acid . . .	43	57.44	58.7 +	1	
Water	25	10.56	9.8 +	1	

- III. Crystals—acicular.

*Species 6. Phosphate of Lime—Apatite—
Asparagus stone.*

		Klap.	Vauq.	Theory.	
I. Lime	55	53.75	54.28	50.8 +	1
Phos. Acid	45	46.25	45.72	49.1 +	1

- II. *Prim.* Regular hexahedral prism.
 III. Crystals—granular—compact (*phosphorite*)—
pulverulent.
 IV. S. G. = 3.09 to 3.2.
 VI. Quartziferous—Calciferous.
 IX. Building material in Spain.

Species 7. Fluuate of Lime—Fluor spar.

I.	Klap.	Thoms.	Rich.	Theory.	
Lime	67.75	67.34	65	63.0 +	1
Flu. Acid	32.25	32.66	35	36.9 +	1

- II. *Prim.* Regular octohedron.
 III. Crystals 70—most complex with 234 planes—
 nodular (*Blue John*)—amorphous (*Chloro-
 phane*)—earthy.
 IV. S. G. = 3.09 to 3.19.
 VI. Quartziferous—aluminiferous.
 IX. Flux—artificial gems—Vases, &c.—etching
 upon glass.

*Species 8. Bi-silicate of Lime—Tabular spar
 —Wollastonite.*

I.	Seybert	Theory.	Klap.	Theory.	Bronsdorff.
Silica	51.	50.88 +	50.	49.83 +	2 || 52.58
Lime	46.	46.11 +	45.	45.16 +	1 || 44.45
Water	1.	....	5.	....	..
Alum. and } Ox. Iron . }	1.33	....	..	....	..
Magnesia } and Loss }	.67	....	..	....	.68
					1.16

- II. *Prim.* Rectangular octohedron P.P'. = 139° 42'.
 M.M'. = 92° 18'.
 III. Crystals—amorphous.
 IV. S. G. = 2.86.

Species 9. Siliceous Borate of Lime—Datholite.

I.	Vauq.	Theory.	Klap.	Theory.
Lime	34.	28.565	35.5	31.6 | 1
Silica	37.66	31.5	36.5	34.8 | 1
Bor. Acid	21.67	21.67	24.	24. | 1
Water	5.5	.....	4.	&c.

- ii. *Prim.* Right rhomboidal prism; M. T. = 109° 28'.
- iii. Crystals 3—Concretionary (*Botryolite*)—amorphous.
- iv. S. G. = 2.98.

Species 10. Arseniate of Lime—Pharmacolite.

I.	Klap. Theory.			
Lime	25.	25.17 +	|	1 |
Ars. Acid	50.54	50.36 +	|	1 |
Water	24.46		|	? |

- iii. Acicular—capillary—mamillary.
- iv. S. G. = 2.54 to 2.6.

Species 11. Tungstate of Lime—Tungsten.

I.	Scheele.	Klaproth.		Berzel. and Theory.
Lime.....	31.	18.7	17.6	19.460 | 19.46 + | 1 |
Tung. Acid 65.	72.25	72.25	77.75	80.417 | 80.53 + | 1 |
Iron .....	...	1.25	...	
Mangan. ....	...	.75	...	
Silica	4.	1.5	3.	

- ii. *Prim.* Acute octohedron P. P' = 130° 20'.
- iii. Crystals 3—amorphous.
- iv. S. G. = 5.5 to 6.

Species 12. Anhydrous Sulphate of Soda and Lime—Glauberite.

I.		Brog.	Theory.	
Anhyd. Sulp. Soda.....	51.	51.06 +	|	1 |
Anhyd. Sulp. Lime	49.	48.93 +	|	1 |

- II. *Prim.* Oblique rhomboidal prism.
 P. M. = $104^{\circ} 30'$; M. T. = $80^{\circ} 8'$.
- III. Crystals 3.
- IV. S. G. = 2.73.

GENUS XXXII. MAGNESIUM.

Magnesia.

Species 1. Hydrate of Magnesia.

I.	Bruce.	Theory.	Vauq.	Theory.	
Magnesia	70.	68.9 +	64.	64.	1
Water	....30.	31.0 +	29.	28.8	1
Silica	....	&c.	2.	&c.	
Iron	.....		2.5		
Loss	.....		2.5		

- II. *Prim.* Right symmetrical prism?
- III. Amorphous.
- IV. S. G. = 2.13.
- VI. Siliciferous (*Meerschaum*); Silica from 5. to 54. per cent.
- IX. Keffekil pipes.

Species 2. Sulphate of Magnesia—*Epsom Salt.*

I.	Berz.	Theory.	Klap.	Theory.	
Magnesia	....19	16.5	33	33.33 +	1
Sulp. Acid	....33	33.	67	66.66 +	1
Water of Crystallis.	} 48				

ii. *Prim.* Right symmetrical prism.

iii. Crystals 4—fibrous—granular—pulverulent.

Species 3. Carbonate of Magnesia—*Magnesite.*

I. Mitch. Buch. Theory. Buch. Theory.

Magnesia ...	47.5	46.59	46.45	48	47.2	1
Carb. Acid	51.	51.	51.	52	52.	1
Silica .....	...	.16	&c.			
Alumina ... ..	...	1.				
Iron .....	...	.25				
Water	1.5	1.				

	Bert.	Theory.		Bert.	Theory.		Bert.
Magnesia	23.	23. }	1	35.	34.	1	25.5
Car. Acid	36.	25.3 }	1	37.4	37.4	1	10.5
.....	.....	10.6 } 1.		...	&c.		...
Lime	14.	14. } 1.		...			...
Water	4.5	&c.		1.			12.
Silica	20.6			26.			52.

	Bert.	Theory.		Klap.	Theory.	
Water	4.8	2.1		3	1.44	
.....	.....	2.7 } 1.		..	1.55 } 1.	
Magnesia	44.	6. } 1.		48	3.45 } 1.	
.....	.....	38. }	1	..	44.54 }	1
Carb. Acid	41.8	41.8 }	1	49	49. }	1
Silica	9.4	&c.		..	..

iii. Sub-granular — spongiform — pulverulent — amorphous.

iv. S. G. = 2.1751.

*Species 4. Carbonate of Lime and Magnesia—
Bitterspar—Pearlspar.*

I.		Hising. Theory.			Klap. Theory.				
Lime.....	29.8	29.8	} 1.	} 1	Lime.....	29	29	} 1	} 1
Carb. Acid	47.6	22.6	} 1.		Carb. Acid	23	22	} 1	
.....	....	23.7	} 1.		Carb. Mag.	45	45	
Magnesia	21.6	21.6	} 1.		Iron	3	&c.		
Iron	1.	&c.							

- ii. *Prim.* Obtuse rhomboid P. P' = 106° 15'.
- iii. Crystals—amorphous.
- iv. S. G. = 2.48 to 2.88.
- vi. Miemite ; S. G. = 2.8.

		Klap. Theory.	
Carb. Lime.....	53.	52.2	1
Carb. Magnesia	42.5	43.2	1
Carb. Iron and Mang. ..	3.		

Dolomite—Conite—Magnesian Limestone (*compact Dolomite*).

Species 5. Borate of Magnesia—Boracite.

I.	Pfuff.	Theory.	Westr.	
Magnesia	30.68	42.62	1	13.5
Bor. Acid	54.54	54.54	1	68.
Silica	2.27	&c.		2.
Alumina .....	..			1.
Lime .....	..			11.
Iron .....	.57			.75
Loss	11.94			3.75

- ii. *Prim.* Cube.
- iii. Crystals 5.
- iv. S. G. = 2.56.

Species 6. Silicate of Magnesia—Chrysolite—Peridot.

I.	Vauq.	Theory.	Klap.	Chen.
Silica	38.	39.33	1	39.
Magn.	50.5	49.16	1	43.5
Iron	9.5	&c.		19.
Loss	2.			7.5
				..

ii. *Prim.* Right rectangular prism.

iii. Crystals 6—granular.

iv. S. G. = 3.4.

vi. Olivine; S. G. = 3.26.

	Klap. Theory.	Klaproth.	Howard. Theory.
Silica. .41.	10.2	50.	52.
.....	30.8	..	..
Magn. 38.5	38.5	38.5	37.75
Iron ..18.5	&c.	12.	10.75
Lime . . .		.25	.12
meteoric			decomp.
			1 Nickel
			1 Loss

GENUS XXXIII. BARIUM.

Barytes.

Species 1. Sulphate of Barytes—Heavy Spar.

I.	With. Klap.	Bert.	Strom.	Theory.
Barytes....	67.2	67	66	65.8
Sulp. Acid	32.8	33	34	33.87
Iron .....		..	..	.05
Water .....		..	..	.05
Loss .....		..	..	.32

- II. *Prim.* Right rhomboidal prism, M. T. = $101^{\circ} 42'$.
- III. Crystals 73 — fibrous — radiated (*Bolognian stone*) — concretionary — compact (*Cawk*); S. G. = 4.8—Earthy.
- IV. S. G. = 4.3 to 4.7.
- VI. Fetid (*Hepatite*.)
- IX. Bolognian phosphorus (*pyrophorus*) — white paint.

Species 2. Carbonate of Barytes—*Witherite*.

I.		Pell.	Vauq.	Klap.	&	Theory.
	Barytes.....	62	74.5	78	1	
	Carb. Acid	22	22.5	22	1	
	Water	16	..	..

- II. *Prim.* Obtuse rhomboid P. P'. = $93^{\circ} 54'$.
- III. Crystals 5—acicular—sub-fibrous—stalactitic—amorphous.
- IV. S. G. = 4.2919 to 4.3.
- IX. Poisonous qualities.

GENUS XXXIV. STRONTIUM.

Strontian.

Species 1. Sulphate of Strontian—*Celestine*.

I.		Vauq.	Klap.	Stromyer.	Theory.
	Strontian. .54	58	56.39	56.5 +	1
	Sulp. Acid 46	42	42.95	43.4 +	1

- II. *Prim.* Right rhomboidal prism, M. T. = $104^{\circ} 48'$.
- III. Crystals 3 — acicular — fibrous — stellated — amorphous — pseudomorphous.
- IV. S. G. = 3.4 to 4.
- VI. Calcariferous; Carb. Lime = 8 per cent.

Species 2. Carbonate of Strontian—*Strontianite*.

I.	Klap.	Hope.	Pell.	Stromyer.	Theory.	
Strontian ...	69.	61.21	62	70.313	70.27	1
Carb. Acid 30.		30.2	30	29.687	29.72	1
Water .....	.5	8.59	8	.....	....	.

- II. *Prim.* Obtuse rhomboid P. P'. = $99^{\circ} 35'$.
- III. Crystals 3—fibrous—stellated—amorphous.
- IV. S. G. = 3.65.

GENUS XXXV. ALUMINUM.

Species I. Alumina—*Corundum*—*Sapphire*.

- II. *Prim.* Acute rhomboid, P. P'. = $86^{\circ} 4'$.
- III. Crystals 13—Laminar—fusiform.
- IV. S. G. = 3.975 to 4.3.
- VI. Adamantine spar (*imperfect corundum*);
Alumina = 86 per cent.

Emery.

	Tenn.	Vauq.
Alumina	50	70
Ox. Iron	32	30
Silex	8	
Residue	4	

ix. Jewelry—polishing powder.

Species 2. Hydrate of Alumina?—*Diaspore.*

I.	Vauq.	Theory.
Alumina	80	51 | 1
Water	17	17 | 1
Iron	3	

ii. *Prim.* Right rhomboidal prism, M. T. = 130°.

iii. In laminated masses.

iv. S. G. = 3.4324.

vi? Gibbsite; stalactitic; S. G. = 2.4.

	Torrey.	Theory.
Alumina	64.8	52.05 | 1
Water	34.7	34.7 | 1
Loss . . . . .	.5	

Species 3. Sulphate of Alumina—*Alum.*

I.	Klap.
Alumina	15.25
Sulp. Acid and)	77.
Water	
Potash . . . . .	.25
Ox. Iron	7.5

- ii. *Prim.* Regular octohedron.
 iii. Crystals 5—capillary—fibrous (*plumose alum*)
 —concretionary—amorphous.
 ix. Uses in dying.

Species 4. Subsulphate of Alumina?—
Aluminite—Websterite.

I.	Strom.	Simon.	Buch.
Alumina	30	32.5	31.
Sulp. Acid	24	19.25	21.5
Water	45	47.	45.
Silex . . . . .		.43	1.
Carb. Lime . . . . .		.35	.5
Iron . . . . .		.45	.5
Loss . . . . .		....	.5

- iii. Mamillary—pulverulent—amorphous.
 iv. S. G. = 1.6.
 vi. Siliciferous subsulphate of Alumina?

Water	88.1	} Dr. Henry.
Alumina	6.5	
Sulp. Acid	3.	
Silica	2.4	

Species 5. Alkilino-subsulphate of Alumina?

Alumina	38.654	} Cordier.
Sulp. Acid	35.495	
Potash	10.021	
Water & Loss	14.830	

- ii. *Prim.* Acute rhomboid?
 iii. Crystals 2.
 iv. S. G. = 2.7517.

*Species 6. Phosphate of Alumina—Wavellite
—Hydrargillite.*

	Berzel.	Theory.		Klapr.	Davy.	
i. Alumina	35.35	33.30	1	71.5	68.	70.
Phos. Acid ..	33.40	33.40	1	....	....	...
Water	26.80	21.47	2	28.	26.5	26.5
Flu. Acid	2.06	&c.		....	....	....
Lime . . . . .	.50			....	...	1.4
Ox. Iron and Ox. Mangan. }	1.25			.....5	1.	...

ii. *Prim.* Oblique rhomboidal prism?

iii. Crystals 2. — Acicular — fibrous — radiated globules.

iv. S. G. = 2.2 to 2.7.

vi. Crystalline character of Wavellite, impressed on clay-slate.

*Species 7. Silicate of Alumina? Cyanite—
Disthene—Sappare.*

	Sauss.	Theory.	Laugier.	Theory.	
i. Alumina ..	54.5	53.58	55.5	55.5	1
Silica	30.62	31.54	38.5	31.9	1
Lime	2.02	&c.	.5	&c.	
Magnesia ..	2.3		...		
Ox. Iron ..	6.		2.75		
Water and) Loss }	4.56		2.75		

ii. *Prim.* Oblique irregular four-sided prism,
P. M. = 106° 55'; M. T. = 106° 15'.

III. Crystals 5—Acicular.

IV. S. G. = 3.517.

VI. Rhætzite.

APPENDIX ?

Fibrolite.

I. Alumina	58.25	} Chenevix.
Silica	38.	
Ox. Iron . . . . .	.75	
Loss	3.	
		46
		33
		13
		8

III. Fibrous.

IV. S. G. = 3.2.

Species 8. Fluato of Soda and Alumina—
Cryolite.

	Klap.	Vauq.	Theory.		
I. Alumina	24	21	24.6	1	} 1
Flu. Acid	40	46	15.5	1	
.....	..	..	31.1	2	
Soda	36	33	29.3	1	
	100	100	100.5		

II. *Prim.* Right rectangular four-sided prism?

III. Fibrous—amorphous.

IV. S. G. = 2.949.

Species 9. Mellate of Alumina—*Mellite*

I. Alumina	16	} Klaproth.
Mellitic Acid	} 84	
and Water		

II. *Prim.* Symmetrical octohedron, P. P. = 93° 2'.

III. Crystals 3.—Granular.

IV. S. G. = 1.6.

GENUS XXXVI. ZIRCONIUM.

Zirconia.

Species 1. Silicate of Zirconia—*Zircon.*

i. *Jargoon.*

	Klap.	Theory.		Klapr.	
Zirconia ..	69.	69.	1	68.	64.5
Silica	26.5	24.5	1	31.5	32.5
.....	..	2.		..	....
Ox. Iron ..	.5	&c.		..5	1.5
Loss	4.			..	....

Hyacinth.

	Klap.	Theory.		Vauquelin.		
Zirconia	70.5	70.	1	66	65.5	64.4
Silica	25.	24.88	1	31	31.	32.
.....	....	.11		....	....	....
Ox. Iron ...	.5	&c.		2	1.5	2.
Loss.....	4.5			1	2.	2.

Zirconite.

	Klap.	Theory.		John.	Theory.	
Zirconia ...	65.	65.	1	64.	64.	1
Silica	33.	23.1 +	1	34.	22.7 +	1
.....	..	9.8 +		....	11.2 +	
Ox. Iron ...	..	&c.		.25	&c.	
Magnesia ..	1.			....	
Ox. Titanium..				1.		

ii. *Prim.* Symmetrical octohedron, P. P' = 84° 20'.

iii. Crystals 45.—Granular.

iv. S. G. = 4.38 to 4.41.

GENUS XXXVII. YTTRIUM.

Species 1. Silicate of Yttria?—*Gadolinite.*

	Berzelius		Vauq.	Klap. Ekeberg.		
Silica	29.18	24.16	25.8	25.5	21.25	23.
Yttria . . .	47.3	45.93	45.	35.	59.75	55.5
Ox. Cerium	3.4	16.9	16.69	....	....	....
Ox. Iron ..	8.	11.34	10.26	25.	17.5	16.5
Ox. Mang.	1.3	...	....	2.	....	....
Lime	3.15	....	....	2.	Alu. 5	....
Glucina ..	2.	....	....	....	....	....
Water ...	5.2	....	....	....	.5	....
Loss	&c.	.6	.6	10.6	....	.5
Theory.						
Silica	18.92	18.37	18.	1		
Yttria . . .	47.3	45.93	45.	1		

ii. *Prim.* Oblique rhomboidal prism, M.T. = 109° 28'.

iii. Crystal 1.—Amorphous.

iv. S. G. = 4.

GENUS XXXVIII. GLUCINUM.

Glucina.

Species 1. Emerald—*Beryl.*

	Vauq.	Theory.	Vauq.	Theory.	
Silica	64.6	64.7 +	68.	68.5 +	8
Alumina	14.	13.6 +	15.	14.4 +	1
Glucina	13.	13.2 +	14.	14.0 +	1
Lime	2.56	&c.	2.	&c.	
Ox. Iron ..	....		1.		
Ox. Chrome...	3.5		...		

	Berz.	Theory.	Klap.		Gmelin.	
Silica	68.35	60.	8	68.5	66.45	54.75
Alumina ...	17.6	14.85	1	15.75	16.75	24.41
Glucina ...	13.13	13.13	1	12.5	15.5	15.4
Iron	72	&c.		1.	.6	1.5
Tantal.	27			....	....	&c.
Ox. Chrome ...				3.	....
Lime .....	....			.25	....

ii. *Prim.* Regular hexahedral prism.

iii. Crystals 8.—Cylindrical.

iv. S. G. = 2.7227 to 2.7755.

Species 2. Euclase.

	Vauq.	Berzelius.
i. Silica	35.	43.22
Alumina	22.	30.55
Glucina	12.	21.78
Ox. Iron	3.	2.22
Ox. Tin ... ..	....	.7
Loss	28.	....

ii. *Prim.* Oblique rectangular prism, P. M. = 130° 8'.

iii. Crystals 2.

iv. S. G. = 3.0625.

MINERALS

WHOSE GENUS IS UNCERTAIN.

Species. Topaz.

	Klaproth.		Berz.	Vauquelin.		
i. Silica	35.	44.5	34.01	28.	39.	31.
Alumina ..	59.	47.5	58.38	47.	49.	68.
Flu. Acid..	5.	7.	7.75	17.	20.	..
Iron.....	..	.5	..	4.	..	..
Loss.....	1.	.5	..	4.	2.	1.

ii. *Prim.* Rectangular octohedron, P. P. =
88° 2', M. M. = 122° 42'.

iii. Crystals 37—amorphous.

iv. S. G. = 3.5311 to 3.564.

vi. Pyrophyssalite—*Physalite*; S. G. = 3.41.

	Hisinger	Berzel.
Silica	32.88	34.36
Alumina ..	53.35	57.74
Flu. Acid ..	..	7.77
Lime .....	.88	..
Iron .....	.88	..
Loss	12.11	..

Pycnite.—*Schorlaceous Beryl*; S. G. = 3.48.

	Buch.	Berz.	Klap.	Vauq.	
Silica	34.	38.43	43.	30.	36.
Alumina ..	48.	51.	49.5	60.	52.6
Flu. Acid ..	17.	8.84	4.	6.	5.8
Iron .....	..	..	1.	..	..
Water .....	..	..	1.	1.	..
Lime .....	..	..	..	2.	3.3
Loss .....	..	..	1.5	1.	1.5

Species. Spinelle—*Spinelle Ruby.*

	Vauq.	Klap.
i. Alumina	82.47	74.5
Silica .....	..	15.5
Magnesia	8.75	8.25
Lime .....	..	.75
Ox. Iron . . . . .	..	1.5
Chr. Acid	6.18	..
Loss	2.57	..

ii. *Prim.* Regular octohedron.

iii. Crystals—granular.

iv. S. G. = 3.645 to 3.76.

vi. Pleonaste—*Ceylanite*—*Blue Spinelle.*

	Desc.	Berz.
Alumina	68.	72.25
Silica	2.	5.48
Magnesia	12.	14.63
Ox. Iron	16.	4.26
Loss	2.	..

Zinciferous Spinelle—*Automalite*—*Gahnite*;
S.G. = 4.7.

	Ekeberg.	Vauq.
Alumina	60.	42.
Silica	4.75	4.
Ox. Iron	9.25	5.
Ox. Zinc	24.15	28.
Loss	1.75	..

Species. Chrysoberyl—*Cymophane*.

	Klapr. Achard.	
I. Alumina	75.5	64.
Silica	18.	15.
Lime	6.	17.
Ox. Iron	1.5	1.
Loss	3.	

II. *Prim.* Right rectangular four-sided prism.

III. Crystals 5—granular.

IV. S.G. = 3.796.

Species. Tourmaline—*Schorl*.

	Vauquelin.		Hern.	
Silica	42.	45.	47.27	47
Alumina	40.	30.	45.46	28
Soda	10.	10.	..	..
Lime . . . . .	..	..	1.78	7
Magnesia . . . . .	..	..	..	10
Ox. Mang.	7.	12.	5.49	2
Loss	1.	2.	..	6

} *Rubellite*
} *Siberite.*

	Vauq. Berg.		Klap- Buch.		
Silica	40.	37.	36.75	36.5	35.5
Alumina ...	39.	39.	34.5	33.75	33.25
Potash .....	....	....	6.	....	....
Lime	3.84	15.	....	.25	.5
Magnesia....	....	....	.25	6.08	9.3
Ox. Iron ...	12.5	9.	21.	8.	5.10
Ox. Mang....	2.	....	....	....	....
Water .....	....	....	....	1.5	....
Loss	2.66	....	....	13.92	16.35

} *Green Tourmaline.*

} *Common Tourmaline.*

II. *Prim.* Obtuse rhomboid, P. P. = 133° 26'.

III. Crystals 18—acicular—capillary.

IV. S. G. = 2.87 to 3.4.

VI. Indicolite.

Species. Garnet.

	Klaproth		Vauq.	
Silica	35.75	40.	43.	36.
Alumina ..	27.25	28.5	15.5	22.
Ox. Iron ..	36.	16.5	29.5	41.
Lime.....	....	3.5	1.75	3.
Ox. Mang..	.25	.25	.5	
Magnesia ..	....	10.	8.5	

} *Precious.*
} *Pyrope.*
} *Almandine*
} *Syrian.*

	Klapr.	Vauq.	Hesinger.	Weig.	
Silica	35.5	44.	34.	34.53	36.5
Lime	32.5	33.5	33.	34.26	30.8
Ox. Iron ..	24.25	12.	25.5	36.05	28.7
Alumina ..	6.	8.5	6.4	1.	....
Ox. Mang..	.4	....	....	....	....
Water .....	....	....	....	.5	4.
Loss .....	....	2.	1.1	3.56	....

} *Melanite.*

	Laugier.	Simon.	Vauq.	Rose.	Vauq.	John.
Silica ..	40.	35.	35.	37.	52.	35.2
Alumina .	20.	15.	8.	5.	20.	.2
Lime ...	14.5	29.	30.5	30.	7.7	24.7
Ox. Iron .	14.	7.5	17.	18.5	17.	26.
Ox. Mang. .	2.	4.75	3.5	6.25	....	8.6
Magnesia		6.5	....	....	....	....
Water ..	....	1.	....	....	....	1.05
Loss	5.	.75	....	....	3.3	2.25
	Aplome	Colophonite	Allochroïte		Common	

Pyrenite—Grossular—Topazolite.

- ii. *Prim.* Rhomboidal dodecahedron.
- iii. Crystals—granular—amorphous.
- iv. S. G. = 3.56 to 4.19.
- vi. Manganesian garnet; S. G. = 3.6—Ox. Mang. = 35 per cent.

Species. Cinnamon Stone—Essonite.

	Klap.	Lamp.
i. Silica	38.8	42.8
Alumina	21.2	8.6
Lime	31.25	3.8
Zirconia .....	....	28.8
Ox. Iron	6.5	3.
Potash .....	....	6.
Water .....	....	2.6
Loss	2.25	4.4

- ii. *Prim.* Right rhomboidal prism, M. T. = 102° 40'.
- iii. Amorphous fragments.
- iv. S. G. = 3.6.

Species. Idocrase—Vesuvian.

	Klap.	Klap.
I. Silica	35.5	42.
Alumina	22.25	16.25
Lime	33.	34.
Ox. Iron	7.5	5.5
Ox. Mang.....	.25	....
Loss	1.5	2.25

Or,

	Theory.	
Sil. Alum.... 35.3 +	35.3 +	1
Sil. Lime ... 51.2 +	36.9 +	1
..... ..	14.2 +	
Silica	&c.	
&c.		

II. *Prim.* Right symmetrical prism.

III. Crystals 9—amorphous.

IV. S. G. = 3.088 to 3.409.

VI. Gehlenite; S.G. = 2.98.

Silica	29.64	} Fuchs.
Lime	35.5	
Alumina ..	24.8	
Ox. Iron ..	6.56	
Loss	3.3	

Species. Staurolite—Staurotide—Grenatite.

	Klap.		Vauq.	
i. Alumina	52.25	41.	44.	47.06
Silica	27.	37.5	33.	30.59
Ox. Iron	18.	18.25	13.	15.3
Ox. Mang.....	.25	.5	1.	....
Lime .....	....	...	3.84	3.
Loss	2.	2.75	5.16	4.05

ii. *Prim.* Right rhomboidal prism, M. T. = 129° 20'.

iii. Crystals 5.

iv. S. G. = 3.20.

Species. Diopside--Mussite—Alalite.

	Laugier. Theory.	Or,
Silica	57.	51.9 + 4 | Bisil. Lime. 34.7 + 1 |
Lime	16.5	23.5 + 1 | Bisil. Magn. 29.5 + 1 |
Magnesia ...	18.25	16.2 + 1 | ..... 17.9 + 1 |
Ox. Iron & } Ox. Mang. }	6.	&c. | &c.
Loss	2.25	

ii. *Prim.* Oblique rhomboidal prism, M. T. = 92° 55'.

iii. Crystals.

iv. S. G. = 3.31.

vi. Sahlite.

	Vauq.	Theory	Hising.	Theory.	
Silica	53.	52.1 +	54.18	53.6 +	4
Lime	20.	23.6 +	22.72	24.3 +	1
Magnesia.....	19.	16.2 +	17.81	16.8 +	1
Alumina	3.	&c.	...	&c.	
Ox. Mang.	4.		1.45		
Ox. Iron.....	...		2.18		
Loss	1.		1.2		

Augite—*Pyroxene.*; S. G. = 3.226 to 3.6.

	Tromsd.	Klap.	Simon.	Seybert.	Roux.
Silica	54.	55.	52.	50.33	45.
Lime	16.2	12.5	25.5	19.33	30.5
Magnesia....	14.	13.75	7.	6.83	....
Alumina	3.05	5.5	3.5	1.53	3.
Ox. Iron ...	7.	11.	10.5	20.4	16.
Ox. Mang....	2.	....	2.25	....	5.
Potash	5.18	....	....	....	....
Water .....	....	1.	.5	.66	....
Loss .....	....	....	....	.92	.5

Coccolite.

	Vauq.	Theory.	
Silica	50.	Bisil. Mag.	26. | 1 |
Lime	24.	Bisil. Lime ..	30.5 | 1 |
Magnesia	10.	.....	19.9
Alumina	1.5	Silica.....	13.5
Ox. Iron	7.	&c.....	....
Ox. Mang.....	3.		
Loss	4.5		

Species. Hornblende—*Amphibole.*

I.	Laugier. Klap. Berg.		
Silica	42.	47.	58.
Lime.....	9.8	8.	4.
Magnesia	10.9	2.	1.
Alumina	7.69	26.	27.
Ox. Iron	22.69	15.	9.
Ox. Mang.....	1.15	....	....
Water	1.92	....	....
Loss	3.85	2.	1.

II. *Prim.* Oblique rhomboidal prism, M. T. = 124° 36'.

III. Crystals II — acicular — fibrous—granular—amorphous.

IV. S. G. = 2.5 to 3.6.

VI. Pargasite ; S. G. = 3.11.

Silica	42.01	} Bonsdorff.
Alumina	14.08	
Lime.....	14.28	
Magnesia	18.27	
Ox. Iron	3.52	
Ox. Mang... ..	1.02	
Water	3.9	
Loss	3.92	

Actynolite — Actinote — Strahlstein; S. G. = 3.33.

	Berg.	
Silica	50.	72. 54.
Alumina .....	.75	2. 27.
Lime.	9.75	6. .33
Magnesia	19.25	12. 20.
Ox. Iron	11.	7. 4.
Ox. Chrome ..	5.	
Water	3.	
Loss	1.25	

Tremolite; S. G. = 2.92 to 3.2.

	Chen.	Klap.	Lowitz.	Lowitz.
Silica	27.	65.	52.	44
Lime	21.	18.	20.	20
Magnesia	18.5	10.33	12.	30
Alumina ...	6.	....	....	...
Ox. Iron....	....	.16	...	6
Carb. Acid	26.	6.5	12. } C. Lime	....
Loss	1.5	....	4.	....

} *Grammate.*
} *Baikalite.*

	Langier.			
Silica	50	35.5	41.	28.4
Lime	18	26.5	15.	30.6
Magnesia	25	16.5	15.25	18.
Water and } Carb. Acid.... }	5	23.	23.	25.
Loss	2	....	5.75	....

} *Grammate.*

Fibrous—asbestiform.

Species. Hypersthene—*Labrador Hornblende.*

I.		Klapr.	Theory ?
Silica	.....54.25	Bisil. Iron	....46.27 + | 1 |
Magnesia	....14.	Bisil. Magn.	....35.38 + | 1 |
Ox. Iron	....24.25	.....	..... 1.0 +
Alumina	.... 2.25	Silica	..... 10.07 +
Lime	..... 1.5	&c.	.....
Water	..... 1.		
Loss	..... 2.5		

- II. *Prim.* Right rhomboidal prism, M. T. = 81° 48'.
- III. Crystals 2—acicular—amorphous.
- IV. S. G. = 3.3857.

Species. Diallage—*Schiller spar.*

	Gmelin.	Drap.	Heyer.	Klap.	Vauq.
Silica	....43.7	41.	52.	Bronzite. { 60. 27.5 10.5.......5 1.5	Smaragdite. { 50. 6. 5.5 11. 13. 4.5 7.5 } Chromc.)
Magnesia	11.3	29.	6.		
Ox. Iron	23.7	14.	27.5		
Alumina	17.9	3.	23.33		
Lime.....	....	1.	7.		
Water	....	10.			
Loss	.....	2.			

- II. *Prim.* Oblique irregular quadrangular prism, P. T. = 109° 18'.
- III. Crystal 1—acicular—amorphous.
- IV. S. G. = 3.

Species. Anthophyllite.

I.

John.

Silica	.....62.66	56.01
Alumina	....13.33	13.3
Lime	..... 3.33	3.33
Magnesia	.. 4.	14.
Ox. Iron	....12.	6.
Ox. Mang.	... 3.25	3.
Water	..... ..	1.43
Loss	..... 1.43	..

II. *Prim.* Right rhomboidal prism, M. T. = $73^{\circ} 44'$.

III. Crystal I—acicular—amorphous.

IV. S. G. = 3.2.

Species. Epidote—*Thallite*—*Pistacite*.

I.

Vauq. Chen. Cordier.

Silica	.....37.	45	33.5
Alumina	....21.	28	15.
Lime	.....15.	15	14.5
Ox. Iron	....24.	11	19.5
Ox. Mang.	.. 1.5	..	12.
Loss	..... 1.5	..	5.5

II. *Prim.* Right irregular four-sided prism, M. T. = $114^{\circ} 37'$.

III. Crystals $\tilde{\gamma}$ — granular — arenaceous — amorphous.

IV. S. G. = 3.4529.

vi. Zoisite ; S.G. = 3.26 to 3.31		Scorza ; S.G. = 3.13
	Laugier. Klap.	Klap.
Silica	37. 45	43.
Alumina .26.6	29	21.
Lime . . .20.	21	14.
Ox. Iron .13.	3	16.5
Ox. Mang. .6	..	.25
Water .. 5.8	..	..
Loss	1. 2	5.25

Species. Axinite—*Thumerstone.*

	Vauq.	Theory ?	Klaproth.		
Silica	44	43.2	4	50.5	52.7
Lime	19	19.575	1	17.	9.4
Alumina	18	18.225	1	16.	25.6
Ox. Iron	14	&c.		9.5	9.6
Ox. Mang.	4			5.25	..
Potash . . . . .				.25	..
Loss	1			..	2.7
<i>Or,</i>					
Bisil. Lime		41.175	1		
Bisil. Alum.		39.825	1		
&c. . . . .		..	

ii. *Prim.* Right irregular four-sided prism.

iii. Crystals 18—lamelliform.

iv. S. G. = 3.213.

Species. Lazulite—*Azurite.*

I. Tromsd. Klap.

Silica.....	10.	46.
Alumina	66.	14.
Lime.....	2.	..
Carb. Lime .. .		28.
Sulp. Lime .. .		6.5
Magnesia	18.	..
Ox. Iron	2.5	3.
Water		2.

II. *Prim.* Rhomboidal dodecahedron.

III. Crystals 2—Amorphous (*Lapis Lazuli.*)

IV. S. G. = 2.767 to 2.945.

Species. Harmotome—*Cross stone.*

I. Keyer. Klap. Tassaërt.

Silica.....	44	49	47.5
Alumina	20	16	19.5
Barytes	24	18	16.
Water		15	13.5
Loss	12	2	3.5

II. *Prim.* Symmetrical octohedron, P. P' = 86° 36'.

III. Crystals 13.

IV. S. G. = 2.30 to 2.35.

Species. Meionite.

I. Silica.....	58.7	} Arfwedson.
Alumina	19.95	
Potash	21.4	
Lime.....	1.35	
Ox. Iron .....	.4

- II. *Prim.* Right symmetrical four-sided prism.
 III. Crystals 3—In grains.
 IV. S. G. = 2.612 to 3.1.

Species. Nepheline—*Sommeite.*

	Vauq.	Theory?	or	
Silica .. 46	44.71 +	3	|	Sil. Alum. .40.0 + | 1 |
Alumina 49	50.28 +	2	|	Bisil. Al. . .54.9 + | 1 |
Lime .. 2	&c.			
Ox. Iron 1				
Loss .. 2				

- II. *Prim.* Regular hexahedral prism.
 III. Crystals 2—acicular—granular.
 IV. S. G. = 3.2741.

Species. Pinite.

I.	Klapr.	Drapier.
Silica.....	29.5	46.
Alumina	63.75	42.
Ox. Iron	6.75	2.5
Loss .....	..	9.5

- II. *Prim.* Regular hexahedral prism.
 III. Crystals 3.
 IV. S. G. = 2.92.

Species. Iolite—Dichroite—Cordierite.

i. Silica.....	42.6	43.6	} Gmelin.
Alumina	34.4	37.6	
Lime	1.7	3.1	
Magnesia	5.8	9.7	
Ox. Iron	15.	4.5	
Ox. Mang. ..	1.7	..	
Potash	1.	

ii. *Prim.* Regular hexahedral prism.

iii. Crystals 3—amorphous.

iv. S. G. = 2.56.

Species. Laumonite—Efflorescent zeolite.

i. Silica.....	49.	} Vogel.
Alumina	22.	
Water	17.5	
Lime	9.	
Carb. Acid ..	2.5	

ii. *Prim.* Rectangular octohedron, P. M. = $117^{\circ} 2'$; P. M'. = $98^{\circ} 12'$.

iii. Crystals—acicular—aggregated.

iv. S. G. = 2.23 to 2.3.

Species. Triclasite—Fahlunite.

i. Silica.....	46.79	} Hisinger.
Alumina	26.73	
Water	13.5	
Magnesia	2.97	
Ox. Iron and	} 5.44	
Ox. Mang. . .		

- II. *Prim.* Oblique rhomboidal prism, P. M. = $99^{\circ} 24'$; M. T. = $109^{\circ} 28'$.
 III. Crystal 1—amorphous.
 IV. S. G. = 2.6.

Species. Prehnite—*Koupholite.*

I.	Hassenf. Theory?	Klap. Theory?
Silica .....50.	49.9 + 4	42.87 | 41.94 | 3
Alumina....20.4	21.0 + 1	21.5 | 23.6 | 1
Lime .....23.3	22.6 + 1	26.5 | 25.33 | 1
Magnesia .5	&c.	.. | &c.
Ox. Iron.... 4.9		3.
Ox. Mang.....		.25
Water .... .9		..
Loss		4.63

- II. *Prim.* Right rhomboidal prism, M. T. = $102^{\circ} 40'$.
 III. Crystals 5—fibrous—mamillary.
 IV. S. G. = 2.6097 to 2.6969.

Species. Mesotype—*Needle Zeolite.*

	Smithson.	Gehlen.	Pell. Vauq.
Silica.....49.	53.39	54.4	50 | 50.24
Alumina ....27.	19.62	19.7	20 | 29.3
Soda .....17.	14.69	15.09	.... | ....
Lime	1.75	1.61	8 | 9.46
Ox. Iron ..... ..	..	..	.... | ....
Water 9.5	9.71	9.83	22 | 10.
Loss ..... ..	..	..	.... | 1.

- II. *Prim.* Right rhomboidal prism, M.T. = 93° 22'.
- III. Crystals 6—fibrous and mamillary—pulverulent (*Mealy Zeolite.*)
- IV. S. G. = 2.083.
- VI. Natrolite; S. G. = 2.2.

Silica48.	}	Klaproth.
Alumina	... ..24.25	
Soda	.....16.5	
Ox. Iron	..... 1.75	
Water	..... 9.	

Species. Stilbite—*Foliated Zeolite.*

I.		Gehlen.	Vauq.	
	Silica	55.07	55.61	52.
	Alumina	16.58	16.68	17.5
	Lime	7.58	8.17	9.
	Soda (with some Pot.)	} 1.5	1.53	....
	Water	19.3	19.3	18.5
	Loss .	....	....	3.

- II. *Prim.* Right rectangular prism.
- III. Crystals 6—lamelliform—mamillary.
- IV. S. G. = 2.5.

Species. Apophyllite—*Ichthyophthalmite*—
Fish-eye Stone.

	Vauq.	Rose.	Reiman.
I. Silica	51	55.	52.
Lime .....	.28	25.	24.5
Potash	4	2.25	8.1
Alumina .....	....	....	....
Magnesia .....	....	....	....
Water	17	15.	15.
Loss .....	....	2.75	.4

II. *Prim.* Right symmetrical four-sided prism.

III. Crystals 6.

IV. S. G. = 2.37 to 2.46.

Species. Chabasie—*Cubic Zeolite.*

I. Silica.....	43.33	} Vauquelin.
Alumina	22.66	
Lime	3.34	
Soda (with some Pot.)	9.34	
Water	21.	
Loss ... ..	.33

II. *Prim.* Obtuse rhomboid, P. P'. = 93° 48'.

III. Crystals 3.

IV. S. G. = 2.7176.

Species. Scapolite—Paranthine.

	Abild.	Berz.	Laugier.	Simon.	Ekeberg.
I. Silica	48	61.5	43.	53.	46.
Alumina	30	25.75	33.	15.	28.25
Lime	14	3.	17.6	13.25	13.5
Magnesia . . . . .		.75	....	7.	....
Ox. Iron	1	1.5	.5	2.	.75
Ox. Mang.		1.5	.5	4.5	....
Soda . . . . .		...	1.5	3.5	5.25
Potash . . . . .		....	.5	....	....
Water	2	5.	....	....	3.25
Loss	5	1.	1.4	1.75	3.5

II. *Prim.* Right symmetrical prism.

III. Crystals—acicular—amorphous.

IV. S. G. = 3.71.

APPENDIX I.?

Wernerite.

I. Silica	51.5	50.25	40.	} John.
Alumina	33.	30.	34.	
Lime	10.45	10.5	16.5	
Ox. Iron	3.5	3.	8.	
Ox. Mang.	1.45	2.45	1.5	
Alkali . . . . .	....	2.	..
Water . . . . .	....	2.85	....

II. *Prim.* Right symmetrical prism.

III. Crystal 1—amorphous.

IV. S. G. = 3.6063.

APPENDIX 2. ?

Dipyre.

I. Silica	60	} Vauquelin,
Alumina	24	
Lime	10	
Alkali	2	
Loss	4	

II. *Prim.* Rectangular prism.

III. Crystal 1—acicular.

IV. S. G. = 2.6305.

APPENDIX 3. ?

Gabronite.

	M'Kenz.	John.
I. Silica	71.17	54.
Alumina	13.6	24.
Potash	3.19	} 17.25
Soda . . . . .	....
Lime . . . . .	.4	....
Magnesia . . . . .	...	1.5
Ox. Iron	1.4	1.25
Ox. Mang. . . . .	.4	...
Water	3.5	2.
Loss	6.64	....

III. Crystals?—amorphous.

IV. S. G. = 3.

Species. Häüyne—*Latialite.*

	Vauq.	Gmelin.	
I. Silica	30.	35.48	47.1
Alumina ..	15.	18.85	18.5
Potash ..	11.	15.46	6.4
Lime	5.	2.66	5.4
Sulphate } of Lime }	20.5	21.73	....
Ox. Iron..	1.	1.16	13.7
Water ..	...	1.2	....
Sul. Acid..	....	....	1.2
Loss	17.5	3.45	....

II. *Prim.* Rhomboidal dodecahedron.

III. Crystal 1—granular (*Saphirine*)—massive.

IV. S. G. = 3.33.

Species. Analcime—*Cubic Zeolite*—*Sarcolite.*

	Vauquelin.	
I. Silica	58.	50. | 50.
Alumina ..	18.	20. | 20.
Soda	10.	4.5 | 4.25
Lime	2.	4.5 | 4.25
Water ..	8.5	21. | 20.
Loss	3.5	.... | 1.5

II. *Prim.* Cube.

III. Crystals 3—globular—amorphous.

IV. S. G. = 2. +

Species. Leucite—*White Garnet*—*Amphigene*
—*Vesuvian.*

	Klaproth.		Vauq.	
I. Silica..	53.75	54.23	54.5	56.1
Alumina	24.62	22.	23.5	20
Potash	21.	22.	19.5	20
Lime .....	....	....	..	2
Loss .....	.28	1.	2.5	1
II. <i>Prim.</i> Cube.				
III. Crystal 1—rounded masses.				
IV. S. G. = 2.45 to 2.49.				

Species. Sodalite.

	Ekeberg.	Thoms.	Borkow.
I. Silica.	36.	38.52	45.
Alumina	32.	27.48	24.
Soda	25.	23.5	27.
Lime .....	....	2.70	....
Ox. Iron .....	.25	1.	.1
Water .....	....	2.1	....
Mur. Acid... ..	6.75	3.	....
Loss .....	....	1.7	3.9
II. <i>Prim.</i> Rhomboidal dodecahedron.			
III. Crystals 2—amorphous.			
IV. S. G. = 2. to 2.378.			

APPENDIX ?

Lythrodes.

I. Silica.....	44.62	} John.
Alumina	37.56	
Soda	8.	
Lime	2.75	
Water	6.	
Ox. Iron	1.	

III. Disseminated—amorphous.

IV. S. G. = 2.5.

Species. Mica.

	Klaproth			Vauq.	Berz.
I. Silica.....	47.	48.	42.5	50.	40
Alumina ...	20.	34.25	11.5	35.	46
Potash	14.5	8.75	10.	....	....
Lime.....	....	....	....	1.33	....
Magnesia ...	....	.5	9.	1.35	5
Ox. Iron.....	15.5	4.5	22.	7.	9
Ox. Mang....	1.75	....	2.	....	....
Water .....	....	1.25	1.	....	....
Loss .....	....	....	....	5.33	....

II. *Prim.* Right rhomboidal prism, M. T. = 120°.

III. Crystals 5 — foliaceous (*Muscovy glass*) — lamelliform—pulverulent.

IV. S. G. = 2.53 to 2.93.

APPENDIX I.

Chlorite.

	Lamp.	Vauquelin.		
I. Silica	35.	56	26.	56
Alumina....	18.	18	15.5	18
Potash ....	....	8	2. Mur. Pot.	8
Lime	29.9	3	....	3
Magnesia. ...	....	....	8.	....
Ox. Iron... ..	9.7	4	43.3	4
Water	2.7	6	4.	6
Loss	4.7	5	1.2	5

III. Crystals—earthy—amorphous.

IV. S. G. = 2.82.

VI. Chlorite slate.

APPENDIX 2.

Scaly Talc—*Nacrite*—*Talc granuleux*.

I. Silica	50.	} Vauquelin.
Alumina	26.	
Potash	17.5	
Lime	1.5	
Ox. Iron	5.	

III. Aggregated scales.

APPENDIX 3.

Lepidolite—*Lilalite*.

I.	Klap.		Vauq.	Troms.	John.
Silica	54.5	54.5	54.	52.	61.6
Alumina	38.25	38.25	20.	31.	20.61
Potash	4.	4.	18.	7.	9.16
Lime . . . . .	...	...	4.Fl.	8.5	1.6
Ox. Iron . . . . .	.75	.75	1.	.25	...
Ox. Mang. . . . .	...	...	3.	...	.5
Loss	6.5	...	...	1.25	1.86

III. Aggregated scales.

IV. S. G. = 2.81.

Species. Talc.

I.	Vauq.	Theory.	Klap.	Theory.
Silica	62.	62.8 +	3 | 61.	64.5 + | 3
Magnesia	27.	26.1 +	1 | 30.5	26.9 + | 1
Potash . . . . .	..	&c.	2.75	&c.
Alumina	1.5		..	
Ox. Iron	3.5		2.5	
Water	6.		.5	

- ii. *Prim.* Right rhomboidal prism, M. T. = 120°.
 iii. Crystal 1—scaly—pulverulent—amorphous.
 iv. S. G. = 2.58 to 2.87.
 vi. French Chalk.
 Potstone (*Lapis ollaris.*)

APPENDIX I.

Chlorite?

foliated. earthy.

Silica.....	41.15	37.	} Höpfner.
Magnesia	39.47	43.7	
Alumina	6.13	4.1	
Lime	1.5	6.2	
Ox. Iron	10.5	12.8	
Water	1.5	..	
Loss .....	.10	..

APPENDIX 2.

Steatite—*Soapstone.*

	Vauq.	Klaproth.		Chenev.	
Silica.....	36.	59.5	48.	45.	60.
Magnesia ..	37.	30.5	20.5	24.75	28.5
Alumina ....	..	..	14.	9.25	3.
Lime	2.	..	..	..	2.5
Ox. Iron ..	17.	2.5	1.	1.	2.25
Potash .....	..	..	..	.75	..
Water	4.	5.5	15.5	18.	..
Loss	6.4	2.	..	..	3.73

Agalmatolite.

Precious Serpentine.

	John.	
Silica	42.5	43.07
Magnesia	38.63	40.37
Alumina	1.	.25
Lime . . . . .	.25	.5
Ox. Iron	1.5	1.17
Ox. Mang. . . . .	.62	..
Water	15.2	..
Loss . . . . .	.25	12.45
	Chrome } Volatile }	

Common Serpentine.

Verde Antique.

Species? Asbestos.

I.	Chenev. Berg.		Bergman.	
Silica	59.	64.	64.	63.5
Magnesia	25.	..	..	16.
Lime	9.5	..	..	12.8
Carb. Mag. . . . .	..	17.2	13.6	..
Carb. Lime . . . . .	..	13.5	6.9	..
Alumina	3.	2.7	3.3	1.1
Ox. Iron	2.25	2.2	1.2	6.
Loss	1.25	..	Baryt.6.	....
		Amiantus.		Hard Asbest.

III. Fibrous.

IV. S. G. = 0.9088 to 2.9958.

- VI. Rock-cork—Silica 56.2 to 62 } per cent.
 C. Mag. 22. to 26 } &c.
 Rock-wood, Silica 72. , Carb. Mag. 12.19
 per cent.
 Mountain-leather.
 IX. Ancient cloth.

Species. Felspar.

I.	Vauq. Klap.	Vauq.	
Silica	64 | 68.	} <i>Moonstone.</i> <i>Adularia</i> —	} <i>Common.</i>
Alumina	20 | 15.		
Potash	14 | 14.5		
Lime.....	2 | ..		
Ox. Iron .....	.. | .5		
Water .....	.. | ..	
Loss	2. | 2.		
		62.4 | 74.	
		17. | 14.5	
		
		1.2 | 5.5	
		4. | ..	
		15.4 | ..	
		.. | 6.	

- II. *Prim.* Oblique irregular four-sided prism, P.M.
 = 90°; P. T. = 68° 20'; M. T. = 120'.
 III. Crystals 24—amorphous.
 IV. S. G. = 2.56 to 2.74.
 VI. Glassy felspar.
 Labrador felspar.
 Compact felspar—Saussurite; S. G. = 3.389.
 Decomposed felspar (*Kaolin*).

APPENDIX 1.?

Andalusite.

I.	Vauq.	Guyton.
Silica	38	29.12
Alumina	52	51.07
Potash	8	....
Ox. Iron	2	7.83

III. Crystal—amorphous.

IV. S. G. = 3.16.

VI. Blue felspar; S. G. = 3.06.

Silica	14.	} Klaproth.
Alumina	71.	
Potash . . . . .	.25
Lime	3.	
Magnesia	5.	
Ox. Iron . . . . .	.75
Water	5.	
Chrome25	

Species. Petalite.

I.	Clarke.	Holme.	Arfweds.
Silica	80.	76.25	79.212
Alumina	15.	20.25	17.225
Lithium . . . . .	..	..	5.761
Ox. Mang.	2.5	2.25	....
Water . . . . .	.75	.75	....
Loss	1.75	..	....

II. *Prim.* Right rhomboidal prism, M. T. = 137°
10'.

III. Amorphous.

IV. S. G. = 2.436 to 2.62.

Species. Spodumene—Triphane.

I.	Vauq.	Berz.	Vogel.	Arfwed.
Silica	64.4	67.5	63.5	66.4
Alumina	24.4	27.	23.5	25.3
Potash	5.	....	6.	....
Lithium . . . . .	..	....	....	8.85
Lime	3.	.63	1.75	....
Ox. Iron	2.2	3.	2.5	1.45
Water . . . . .	..	....	2.	....
Loss	1.	1.34	....	....
Volatile . . . . .	..	.53	....	....

II. *Prim.* Octohedron, P. M. = $145^{\circ} 42'$; P. M.
= $79^{\circ} 50'$.

III. Crystal 1—amorphous.

IV. S. G. = 3.192 to 3.2.



MINERAL SPECIES NOT ANALYSED.

*Species.* Helvin.

II. *Prim.* Rhomboidal dodecahedron ?

III. Crystal 1.

IV. S. G. = 3.5.

Species. Chiasolite—*Macle*—*Cross-stone*—*Hollow-spar*.

- II. *Prim.* Rectangular octohedron, P. P'. = 120° ,
M. M'. = $98^{\circ} 10'$.
- III. Crystals 4.
- IV. S. G. = 2.944.

Species. Condrodite.

- II. *Prim.* Oblique rectangular prism, P. M. =
 $112^{\circ} 12'$.
- III. Crystal 1.—In grains.
- IV. S. G. = 3.14.

Species. Spinellane.

- II. *Prim.* Obtuse rhomboid, P. P'. = $117^{\circ} 23'$.

Species. Melilite.

Species. Pseudo-Sommitte.

Species. Crichtonite.

- II. *Prim.* Acute rhomboid, P. P'. = 18° .

Species. Humite.

Species. Ice Spar.

Species. Spinthere.

MINERAL MASSES OF HOMOGENEOUS TEXTURE,
WHICH DO NOT FORM TRUE SPECIES.



Obsidian—Marekanite—Pumice.

Pearl-stone.

Pitch-stone.

Clink-stone.

Basalt.

Common Jade—Axe-stone.

Green Earth.

Slates.

Clays.



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Meteoric Iron	13	Pistacite	92
Mica	104	Pitchblende	53
Miemite	70	Pitchstone	112
Mineral Caoutchouc	9	Plasma	11
Minium	32	Platina	52
Mispickel	18	Platinum	52
Mocha Stone	11	—— native	52
Molybdenum	12	Pleonaste	52
—— sulphuret ..	13	Plumbago	8
Mountain Leather	108	Porcellanite	11
Muriacite	64	Potash	59
Muscovy glass	104	—— nitrate	59
		—— sulphate	59
Nacrite	105	Potstone	106
Naptha	8	Prase	11
Natrolite	98	Prehnite	97
Natron	60	Pseudo-Soumitte	111
Nephele	95	Pumice	112
Nickel	20	Pycnite	82
—— arseniate	21	Pyrope	84
—— arsenical	20	Pyrophysalite	81
—— black ore	21	Pyroxene	88
—— ochre	21		
Nigrine	54	Quartz	10
Nitre	59	Quicksilver	45
		—— horn	46
Obsidian	112		
Ochre	15	Realgar	12
Octohedrite	55	Reddle	15
Olivine	71	Retinasphalt	9
Onyx	11	Rhætitite	77
Oolite	63	Rhodium	58
Opal	11	Rock cork	108
Orpiment	12	—— wood	108
Orthite	57	Rubellite	83
Osmium	58	Ruby-Copper	24
		Rutil	54
Palladium	52		
—— native	52	Sahlite	87
Paranthine	100	Sal Ammoniac	62
Pargasite	89	Salt	60
Pearlspar	70	Saltpetre	59
Pearlstone	112	Saphirine	102
Petalite	109	Sapphire	73
Peridot	71	Sappare	76
Petroleum	9	Sarcolite	102
Pharmacolite	67	Sard	11
Phy salite	81	Sardonyx	11