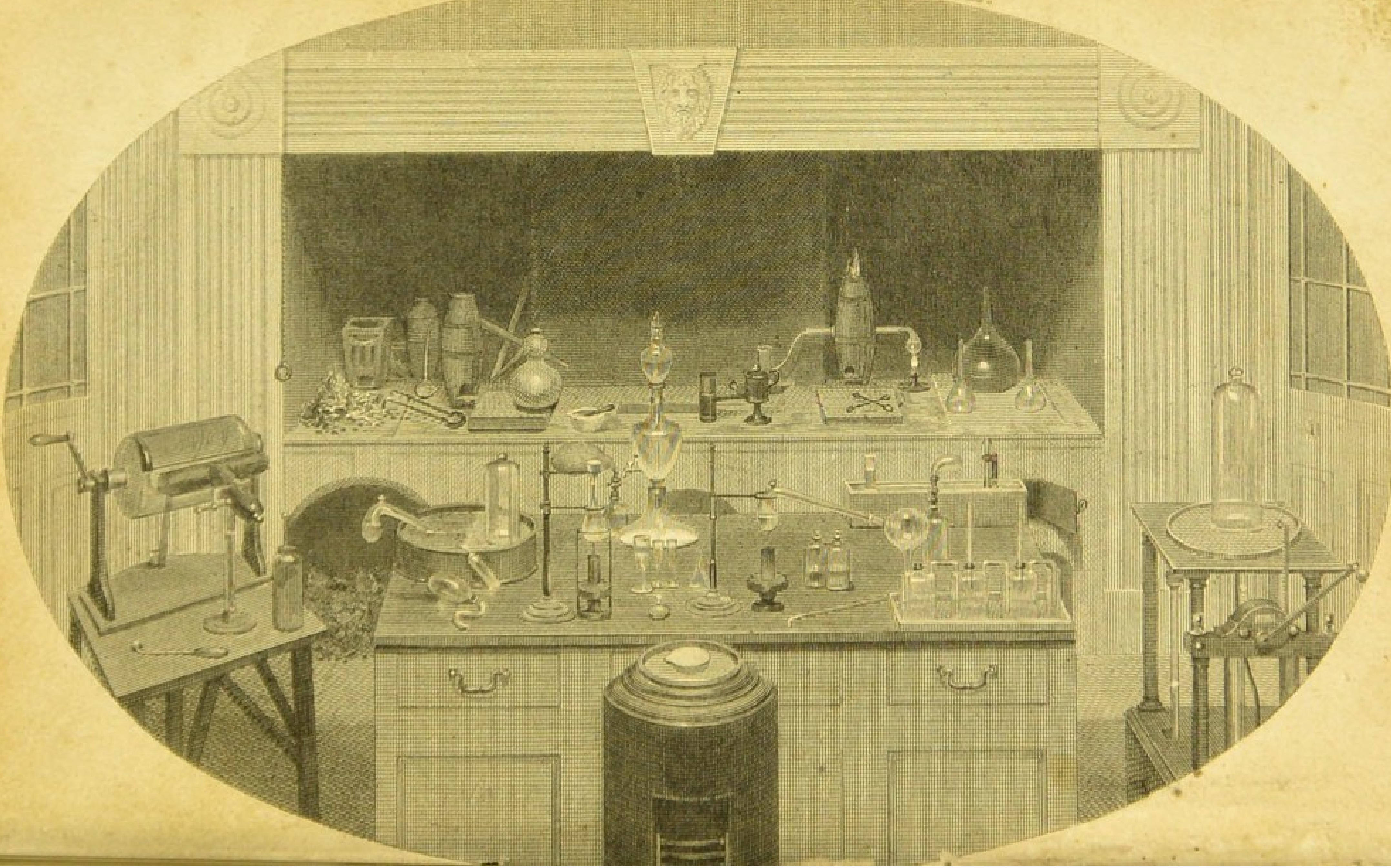
This appears to be an amateur
Copy in the handwriting of Dr
Babington or
Dr. Marcet. It was shewn
in 1886 to Mr. Cornelius
Hanbury of Plough Court
nephew of Mr Allen, who
said the handwriting was
not that of Mr. Allen.
In 1888 the Lecture Theatre
was used as in 1816

Thos. Stevenson

CHEMICAL THEATRE, GUY'S HOSPITAL.



A

SYLLABUS

OF

A COURSE OF

Chemical Lectures

READ AT

GUY's HOSPITAL.

BY

WILLIAM BABINGTON, M.D. F.R.S.
ALEXANDER MARCET, M.D. F.R.S.
PHYSICIANS TO THE HOSPITAL,
AND
WILLIAM ALLEN, F.R.S. & F.L.S.

LONDON:
PRINTED BY WILLIAM PHILLIPS,
GEORGE YARD, LOMBARD STREET.
1816.

PREFACE.

In every Science taught by Lectures, a Syllabus of the Course has been found of advantage to the Student. At the same time that it lays before him a comprehensive outline of the subject, and points out the several divisions and their arrangement with respect to each other, it defines the meaning and extent of scientific terms better than more verbal statements would do, and affords a convenient epitome of the rudiments of the science.

As the objects of Chemistry are various, and its views extensive, so likewise is the connection of its principles subtle, and their investigation complicated and minute: hence the aid of such a synopsis is perhaps even more requisite in this than in any other branch of Natural Philosophy. In proportion too as modern improvements have enlarged the scope of Chemistry, they have increased the utility of a Prospectus to assist in explaining it; if, for instance, we take a retrospective view of the state of Chemical Science eight or ten years ago, it will appear that a number of discoveries have been made since that period, which have opened new fields of investigation, and have in some instances pointed out the imperfection of our former systems.

On these grounds it has been thought right to draw up a Syllabus of the Lectures delivered at this Hospital, and to renew it from time to time, as the progress of the Science may appear to require.

As the Course is necessarily designed for Medical Students, particular attention has been bestowed on those parts which relate to their profession. It is not, however, confined to this object alone. Chemistry is now so intimately connected with various departments of Science, and with most of the Arts and Manufactures, whether useful or ornamental, that an acquaintance with it has become in some degree necessary in the general system of education; and however different the views with which the Gentleman, the Artist, and the Manufacturer may enter upon its study, each will obtain information adapted to the particular line of his pursuit, that will amply reward him for the time he may spend in acquiring a competent knowledge of its principles.

Agreeably to this view of the matter, an endeavour has been made to point out the application of these principles, not only to the purposes of Medicine, but to most others to which Chemistry is in any way allied ; and it is hoped that independently of its convenience during the period of teaching, this Syllabus may be useful to Students when they have ceased to attend ;—that by future perusals they may not only recall such information as length of time or diversity of employment had erased from their memories—but that it may also serve as a general outline of the science, to be filled up at their leisure—as a systematic arrangement to which they may refer whatever knowledge they shall hereafter obtain in this department of Science.

In preparing this Course of Lectures, considerable attention has been paid to the order and distribution of the different parts of the subject. But as Chemical Science, though making daily progress, is not yet sufficiently advanced to admit of a perfect arrangement of its parts, and as the new Nomenclature, though admirably contrived, appears from Sir Humphry Davy's late brilliant discoveries, to have in some instances been at variance with facts, it has been deemed desirable in this Course of Lectures to guard against too strict an observance or hasty adoption of systematic views of arrangement. For this reason, the Synoptic Tables of Nomenclature, which appeared in the former Syllabus, are now suppressed; and a list of the Simple Bodies, that is, of those which, in the present state of our chemical knowledge, we are unable to decompose, has been substituted in their place.

It may be proper to mention, that although all subjects strictly belonging to Natural Philosophy are referred to the Lectures delivered at Guy's Hospital on that subject, yet the Chemical Lectures are occasionally illustrated by such parts of Experimental Philosophy as the subject may immediately require. By the free access, likewise, to an extensive Laboratory, the Student has an opportunity of seeing the various chemical processes conducted upon a scale corresponding with the expenditure of a large Hospital, and thereby of becoming familiarly acquainted with every step necessary in the management of such operations;—without which the demonstrations of a Lecture-room will seldom make that impression which is necessary to fix them in his memory, and enable him to apply them with readiness and effect upon any future and distant occasion.

It is usual to open with a sketch of the science
and its progressive history - but it has been
thought better to pass at once to the object of
the course. The beginning of every science is an
characterized by [illegible] - Chemistry is the
science of the action of minute particles of matter
and it is the study of these laws [illegible] -
Attraction is the force by which bodies tend to
approximate - Repulsion is the property or force
them of receding from each other. Attraction
acts in different modes consequently divided
into species - Attraction of gravitation is that
which acts at sensible distances. According to
Sir Isaac Newton increases according to the quantity
of matter. Decreases as the square of the distance
the planets are by their attracted to each or the [illegible]
It is probably the same in all bodies but whether
this we know not - Some have [illegible] of the
of another - We cannot hope to [illegible]
What is the specific gravity of bodies? The
comparative weight of bodies with another of equal
bulk or volume - suppose a cubic inch of [illegible]
silver or water - Water is the standard of com-
parison - And the proportion the others bear to it
are expressed in reference to their specific gravity

the specific gravity of the bulk of bodies are in
exact ratio to their weights - By the Hydrostatic
balance - we only weigh articles first in air
and afterwards in water - thus-~~begs~~ (Selenium)
weighs 2040 grns - when in water it displaces of
course a bulk of water equal to its own -
and the loss of weight will be the weight of water
displaced: thus is 252 grns - but it has been
agreed always to assume water as 1,000
so as 252 — 2039 — 1000 = 8091.
It is not at all necessary that the figure
should be of a definite shape - as it will always
displace a quantity of water equal to itself.
To airs or fluids this will not apply - but by
enclosing them in a vessel of given ~~weight~~ the
weight of which has been previously ascertained
then weighing it first filled with water - and noting
that weight - then weigh any other fluid you wish -
the proportion of the one to the other will be the
specific gravity - To weigh gases - the same process
is adopted - ~~[illegible]~~ common air for water
and then exhausting it so as to introduce
the gas which is to be weighed - Another
instrument the Hygrometer - for weighing
[illegible]

sinking in fluids in proportion to their specific gravity  the marks for which are struck off on the scale similar made precisely like Fahrenheit – When a body sinks not entirely in a fluid the quantity of fluid displaced is equal to the bulk of the body – the weight to which it sinks in water is marked off on the body and therefore the number of weights required to sink it to that mark is the proportion of the universal weight of a given quantity of water this has been improved by sinking it by a certain weight in distilled water to make it sink to a certain mark so that fluids lighter than water may be calculated –  – thus 700 weight of instrument – the weight additional of spirit of wine is 151 – so that its specific gravity is as ~~151~~ 851 to 1000 – Mr Nicholson

Natural History is the knowledge of bodies as they are found in nature

Chemistry is the knowledge of the laws which govern the attraction of minute particles on each other.
Physics comprehend the various properties of matter.
The attraction of gravitation is that which acts at sensible distances - according to Sir I. Newton it is increased as the quantity of matter, decreased as the square of the distances
Specific Gravity is the comparative weight of bodies when compared with another of equal bulk or volume. Water is always taken as the standard, and the proportions other bodies bear to it are expressed in decimal figures the specific gravity of the bulk of bodies is in exact ratio to their weights

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General division of the study of Nature, under the heads of *Natural History, Physics,* and *Chemistry.* Objects of these various branches of natural science generally stated. Chemistry defined.

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General view of the subject. Cause of *Attraction* not understood. Different species or modifications of attraction. *Gravitation.*—This force is exerted between masses of matter, and often at an immense distance. Distinction between the *specific* and *absolute weight* of bodies, *Areometers.* Experimental illustrations on the subject of specific gravity.

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Crystallization.—Is an effect of the attraction of aggregation. Term *Solution* explained. The formation of crystals, influenced by concentration, refrigeration, rest, atmospheric pressure, &c. and attended with various circumstances, such as change of temperature, of volume, &c. Explanation of the terms *Efflorescence* and *Deliquescence.*—Different susceptibility of crystallization in different salts—how applied to chemical analysis.

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the specific Gravity of bodies of equal weights
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is smaller.
By the Hydrometric balance we weigh bodies
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Between homogeneous particles is shewn by applying two bits of polished lead together, they adhere with a force proportioned to their size.
Chemical attraction is shewn by dipping an iron spatula into a solution of Nitrate of Copper – the copper adheres to the knife.
Or rub by gm: Potash: & Phosphorus 1[gr] of each together in a mortar – a violent detonation takes place. Chemical Attraction is exerted between the heterogeneous particles of bodies.
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Efflorescence is when a salt on exposure to air loses its water of Crystalization.
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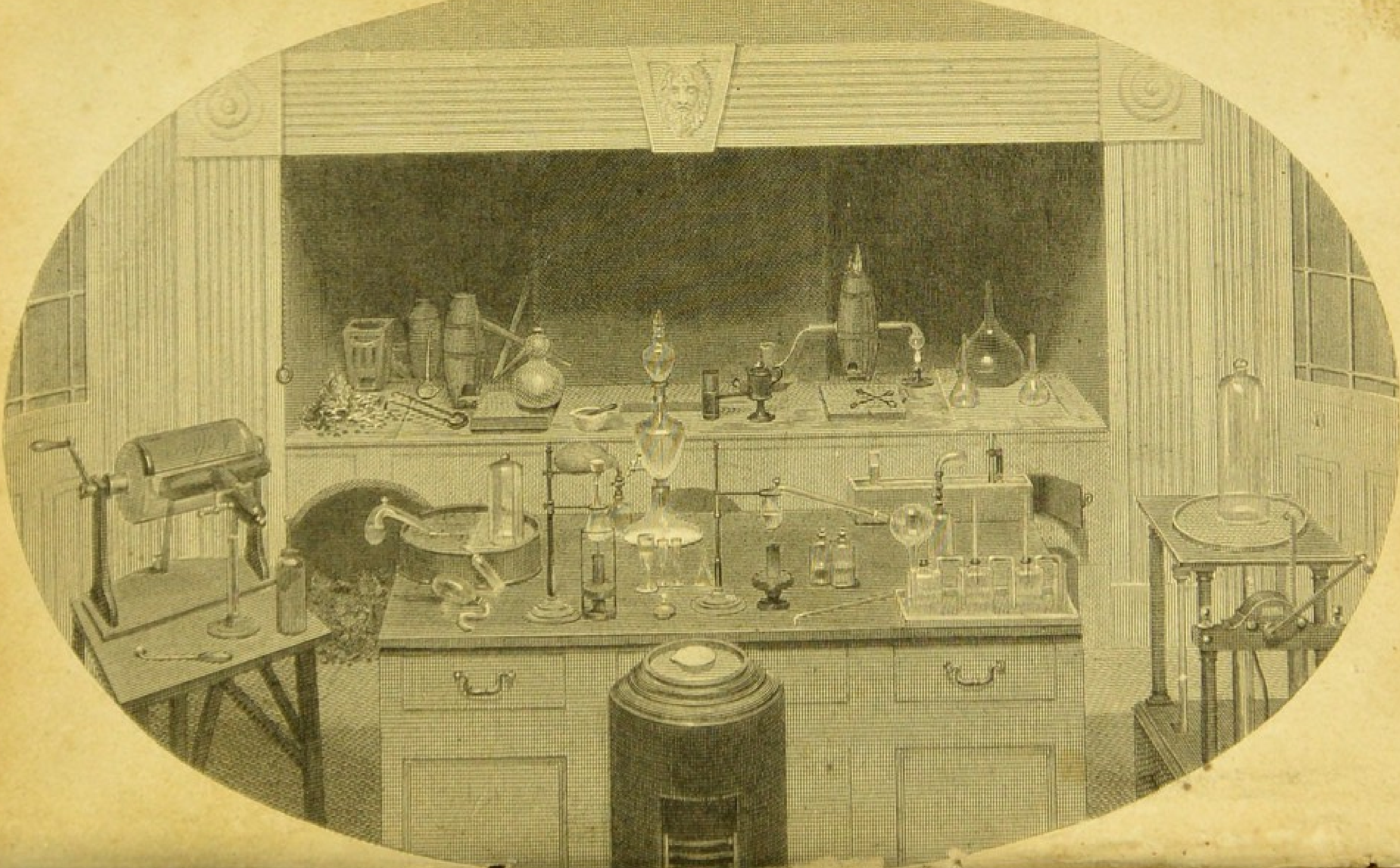
By Chrystalization we are enabled to separate one salt from another according to their different solubility in water – and we may distinguish them after by the shapes of their crystals. – these generally adhere to the sides of the vessel – but are formed round a thread or piece of wood introduced into the solution – but the best mode is to put in a crystal of the same kind as the one we expect to chrystalize.

Every solid susceptible of Chrystalization has a tendency to assume a determinate shape – thus Common Salt (Muri: Soda) forms regular cubes – Nitre a six sided prism – Alum an Octohedron – the same solid admits of variation – Calcareous Spar will form 6 sided prisms and this is called Chrystanites – occasioned by accidental circumstances modifying the attraction of Cohesion.
The Abbé Haüy by the mechanical division a complicated Chrystal – first obtains the simple form and then constructs by the varied accumulation of the simple figure all the observed varieties of that species. The Chrystal will divide in one direction smooth & even whilst in another it will seem fibrous and be the mere effect of force. All the Calcareous Spars yield Rhomboidal. The forms hitherto discovered may be reduced to six – Parallelopipedon – including Cubes – Rhomb – all solids terminating in 6 faces parallel 2 and 2. – Tetrahedron – Octahedron the regular Hexaedral Prism – Dodecahedron with equal & similar rhomboidal planes – and Dodecahedron with triangular planes.

CHEMICAL THEATRE, GUY'S HOSPITAL.



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All the Calcareous spars yield Rhomboids
The forms hitherto discovered may be
reduced to six— Parallelopipedon including
Cubes— Rhomb— all solids terminating in 6 faces
parallel 2 and 2.— Tetrahedron— Octahedron
the regular Hexaedral Prism— Dodeca-
hedron with equal & similar rhomboidal
planes— and Dodecaedron with triangular
planes.

The new compound not only loses the properties
belong to the components but often acquires new — thus
neither Sulphur or Oxygen affect vegetable colours — S. Acid
Eg:
1 Muriatic Acid & Soda combined by Chemical
Attraction forms common Salt — Mur. Soda
Bodies dissolve much quicker when reduced
to powder than in the solid state — as by it
the Attraction of Cohesion is overcome —
Thus if Sulph: Acid be added to a lump of Marble
but little action takes place but when powdered
a violent effervescence —
3. Solution is something more than a mechanical
division, there is some Chemical union as heat is
evolved —
4 Mix Ammoniacal Gas with Muriatic Acid Gas — a decrease
of volume occurs & white flakes are formed which become
solid and is the Muriate of Ammonia. Nitrate of
Copper levigated & spread on some tin foil, and moistened
with a little water, and folded quickly up — a sudden
evolution of heat and even flame is produced —
The same occurs in mixing Nitric Acid with
Oil of Turpentine. To render the Nitric Acid pure

truncations, decrements, &c. and of the mode in which they give rise to all the varieties of forms in crystallized bodies. Hypothesis of spheroidal particles, as developed by Dr. Wollaston. The form of crystals, and the instrument called *Goniometer*, by means of which these forms are accurately ascertained, are important auxiliaries in mineralogical chemistry.

ON CHEMICAL ATTRACTION.

Chemical attraction or *Affinity*, like the attraction of cohesion, takes place in contact or at insensible distances, but differs from the latter in acting between *dissimilar* or *heterogeneous* particles. 1 The result of its action is the formation of a *compound*, with properties differing from those of its constituent parts. Chemical *Analysis* consists in resolving a compound into its constituent or elementary parts. 2 The attraction of cohesion, and chemical attraction may be generally considered as acting in opposition to each other. 3 Process of *Solution* examined. o Thus Citric Acid & Soda mixed in the dry state produce no action, but when water is added a violent action ensues.

o In most instances it is necessary, in order that chemical attraction may take place, that one of the constituents should be in the fluid state. But these can [illegible] rubbed together be decomposed—

4 Chemical combination produces remarkable

[illegible] place a small quantity of Sulph: Acid [illegible] mixed with it.

Colour is destroyed when Pyromuriatic acid & a solution of Indigo are mixed - but a fine colour produced by Liquid Potash & a weak solution of Violets.

changes in the form, colour, density, &c. of the bodies combined, and is generally attended with a change of temperature.

1 Bodies have amongst themselves different degrees of chemical attraction, and it is on the estimation of these different attractive forces that the Science of Chemistry rests.—Methods employed to form such estimates.

2 Definition of the terms *Simple* and *Double elective attraction.*—Experimental illustrations. —*Precipitation.*—*Saturation.*

Of the *limits* of chemical attraction.—Whether bodies can combine together in any proportion; or whether they will unite only in certain determinate proportions?

Berthollet's opinions and scepticisms on the doctrine of determinate proportions generally stated. The quantities or masses of matter—the force of attraction of aggregation—the degree of temperature—considered by him as causes by which the laws of attraction are often modified. These modifications probably only apparent.

Theory of Atoms.—Richter's law respecting the mutual decomposition of salts.—Concise view of the doctrines of Mr. Dalton and other Philosophers on the subject. Dr. Wollaston's Scale of Chemical Equivalents.

..nap is a compound of Animal oil & alkali, differing .. Nature from the constituents — Copper & Acetic acid ..e inoffensive when united from a poisonous compound .. Sulph: Acid and Alumine both noxious substances when united form a simple astringent

..ange of Form — If Oxygen & Hydrogen gases be mixed and the electric spark applied — water is formed — Carbonic acid gas & Ammoniacal gas will form a solid called Carbon: Ammon: — A solution of Mur: Lime and Sulph: Acid — will when mixed make a solid substance — Sulphate of Lime or Gypsum. The Muriatic Acid is set at liberty. — Alum & Acetate of Soda will form a fluid when mixed being dissolved in their water of Crystalization — Diminution of density. Sulph: Acid or Spirit of wine mixed with water a diminution of volume, & evo=lution of Caloric takes place. An increase of den=sity produces heat and vice versa.

.. Bodies which appear to have a great affinity for each other readily separate again, thus Oxyd of Manganese — sometimes united & sometimes separated.

.. Simple elective Attraction — Add to a solution of Nitrate of Lime Sulph: Acid — Sulph: of Lime is formed & Nitric Acid is set free

Sulph: Acid: — Lime — Nitric Acid } Nitr: of Lime

Double elective Attraction — If we add to a solution of Sulph: Soda, Nitric Acid no change takes place ..ut if Lime be added to the N: Acid previously ..n insoluble compound is formed

Dr Cullen explains it thus Nitrate of Soda in Solution

Sulph: Soda { Soda — 50. Nitric Acid 50 — — 44 = 102 Sulph: Acid 54 Lime } Nitrate of Lime

104

Sulph: of Lime precip:

This is a law in Chemistry that bodies unite in definite proportions — Thus if Hydrogen & Oxygen gas's be united in the proportions of 1 Oxygen 7 2 Hydrogen by gains they form water but if 2 volumes of each be used 1 volume of Oxygen will remain unchanged. Richter says that in the decomposition of neutral salts by double elective attraction they have their exact proportions of acid & base. —

Thus if Carbonate of Potash be passed into an endrometer and Muriatic Acid be passed in — 6 p[ts] of Carbonic Acid will be formed — If Subcarbonate be used only 3. When bodies combine together it is in the same bulk or in 2 or 3 times relative to the other and in no intermediate quantity —

The Atomic Theory. Every compound is said to consist of a certain number of Atoms or ultimate indivisible particles, One of them will perhaps unite with, 1, 2, 3, or even 4 portions of another, & not in intermediate proportions. The connection between this doctrine and that of definite proportions is obvious — An Atom is the smallest indivisible body — Water consists of 1 bulk Oxygen — 2. Hydrogen Whenever the same ingredients form different salts it is as 1 to 2 or 1 to 3. ~~Two~~ 4 Volumes of Oxygen to 1 Nitrogen form Nitrous Acid gas whilst 1 of Nitrogen to 5 Oxygen form Nitric Acid

During the days of Aristotle and for 2000
years after fire, water, earth and air were
considered as elementary substances, the 4 elements
this hypothesis has been disproved, and by the
labours of Priestley, Lavoisier, Davy &c. a new
hypothesis is established – Water is now decomposed
by the voltaic battery and found to consist of
Oxygen and Hydrogen, the one inflammable the other
disposed to unite with inflammable bodies.
Adding Sulph: acid: to water & Iron filings, which de-
composes it, the oxygen unites with the Iron, the
Hydrogen is separated in the form of gas – These
may be again united by burning the hydrogen
as it escapes from the tube which unites with
the oxygen of the air and forms water which
may be collected in a glass bell.
Air is found to be composed of Oxygen 21. to
Nitrogen 79. the one aids supporting life and
combustion, the other essential to both.
By the experiments of Sir H. Davy earths are found
not to be simple or undecompoundable substances
but metals in a state of oxidation.
Dr Herschell has proved heat to be an ele-
ment and has separated the solar rays
into heat & light – the heat being at a greater
distance from the Prism.

Caloric or the matter of Heat has been con-
sidered by Newton, Lavoisier & others as a fluid
The French and indeed modern Chemistry has
given the name of Caloric to the matter producing
and Heat to the sensation or effect. Caloric
is imponderable of great expansive power
and invisible. Is divided into free or
Radiated Caloric and combined Caloric

In a free state it produces the sensation of
heat and ultimately disorganisation if
carried too far - It expands bodies from
entering between its particles and separating
them - This is seen more distinctly in fluids
than solids - All bodies do not expand
alike - Those fluids which boil most read-
ily are more expansible. If you mea-
sure water and spirit in 2 tubes and
immerse them in warm water you find
the spirit rises much ~~to the~~ quicker than
water shewing its greater expansibility.
Gases expand equally they have no cohesion
but they possess elasticity - Metals expand
in the following order Mercury - Zinc - Lead -
Tin - Copper - Gold - Bismuth - Iron -
& Platina the least. Nature is always
endeavouring
Expansion to establish an equilibrium of
heat - When water is cooled down to the tem-
perature of 42° tho' cold may be continued
longer it does no longer ~~as~~ contracts but
from that point to 32 it expands - then
if heated it contracts till it rises to 42°
and then expands.

If you immerse a thermometer in cold water, the thermr. parts with its heat to the water — if in warm water the contrary takes place

CLASSIFICATION.

The principles of classification of the older chemists shown to be inconsistent with modern discoveries.—What is to be understood by the term *Element,* or *Elementary Substance.*

General view of the *simple* or *elementary bodies.* Of the principles of arrangement adopted in most modern treatises of Chemistry. Unavoidable difficulties in a systematic classification of chemical knowledge. Statement of the arrangement adopted in this course—reasons which appear to render it most eligible.

OF CALORIC.

Explanation of the terms *Heat* and *Caloric.* Various opinions on the nature of Caloric examined.—Its phenomena may be considered under two general heads, *viz.*

I.—FREE CALORIC, OR HEAT OF TEMPERATURE.

Caloric, in this state, *expands* bodies, and affects the thermometer.—*Equilibrium* of heat. *Thermometer.*—Principle and construction of

Thermometers were first invented by an Italian Physician (Sanctorius) his was a spirit therm- Sir Isaac Newton first invented the Mercurial

that instrument. Description of the various thermometrical scales. Nature and limits of the information derived from these instruments.—Wedgwood's *Pyrometer*.—Peculiarity respecting the expansion of elastic fluids by heat.—Exceptions to the law of expansion by heat.—Expansive force of freezing water.—Contraction of Argil by heat.—*Fusion* and *Vaporization* of bodies.—*Evaporation*, distinguished from *vaporization*.—Influence of the atmospheric pressure on vaporization.

flat [illegible] [illegible] clay [illegible]

Theory of the *Propagation* and *Equilibrium* of free caloric.—*Conducting powers* of bodies. Fluids are very slow conductors when at rest.

Radiation of heat.—Professor Prevost's theory of universal radiation.—*Reflexion* of heat.—Professor Pictet's apparent reflexion of cold.—Leslie's *differential thermometer*.—Bodies differ in their *reflecting, radiating*, and *absorbing* powers.—Explanations and experimental illustrations.—Practical applications of these principles. Dr. Wells' theory on the formation of *Dew*. *Ignition* is the ultimate effect of accumulated caloric in its free state.—Takes place in all bodies nearly at the same temperature.

Mercury boils at 676°. Water at 212°. under an exhausted receiver at any point above 32. – Ether in a vacuum boils at 18°. In the atmosphere at 104 upon a high mountain water boils much sooner than in the common atmosphere.

Feby 10. 1816 – Ther: at 1½° below Zero – & [illegible] of 6 [illegible] the freezing point

To make a thermometer you take a bulb with a tube attached to it - then rarifying the air by heat & immersing the end of the tube in spirit or any other fluid as it cools the fluid enters into the bulb - then is heated & boils again to expel the air and the fluid allowed to enter until so as to fill the bulb & hermetically sealed - In a spirit thermometer the scale cannot go beyond 180° as it then boils - mercury used is used for higher temperatures - The thermometer thermometers - The mercurial thermometer will be hermetically sealed. The Centigrade is used in France - In this between the points of freezing & boiling the scale is divided into 100° and these again into decimals - this the best, that of Fahrenheit being objectionable as its ~~freezing~~ extreme point being a degree of cold produced by a freezing mixture -

Argyl contracts by heat, consequently there is the principle of Wedgwood's pyrometer - a bit of this is put into a groove which gradually tapers and on the heat being increased so it slips along the groove - When clay contracts it then it retains this state with great tenacity and till the last portion is expelled it continues to contract - and when this is done, it then obeys the usual law - expands - Water is an apparent exception to the law - during the freezing of water there is a great evolution of caloric - this expansion is supposed to be owing to the arrangement of its crystals beginning at 42° and continuing to 32°. If a little water be confined in a thick iron tube and placed in a freezing mixture it will burst the Box. [illegible] be screwed down

On Mount Blanc which is 3 miles high water boils at 207°

Differential thermometer consists of 2 bulbs connected with a tube bent between them there is a little fluid which shews the difference of temperature in which the two bulbs may be placed.

When a bottle in which water is boiling be suddenly corked & cooled applied the ebullition ceases, but when the steam is condensed and thus a vacuum produced, it again boils for some time. An experiment is mentioned in France, of throwing iron filings into water when ebullition is produced.

Fusion is when a solid body is converted into fluid on exposure to heat such as metals.

Vapourization such exhalations only as can be again condensed into a fluid.

Evaporation is the conversion of fluids into vapour.

The conducting power of heat is different in different bodies. Metals are the best — Silver gold copper tin iron — Platina steel & lead is the order — Charcoal, hair glass are bad conductors —

In proportion as fluids conduct heat they give us the sensation of cold — thus Mercury will feel cold, while water of exactly the same temperature will feel warm.

You may burn Ether on the surface of water without a thermometer immersed in it being at all affected.

Heat may be reflected from the concave mirrors into a focus so as to ignite gunpowder and to be very sensibly felt by a thermometer.

liable to

The reverse happens when ice is used —

Different bodies absorb — radiate & reflect heat in different degrees — metallic surfaces radiate and absorb very little but reflect much

Mr Leslie took a cubical canister with four surfaces — black — white — glass & polished

Black radiates best, then paper (white) then [illegible] [illegible] lastly the polished [illegible] filled with warm water. The polished reflect least & the black best & the best radiators are the worst conductors. Polished surfaces absorb least & black most & as they reflect most so they absorb least & vice versa. Those in very black clothes are warmer in hot weather or in the sun and colder in shade in proportion to others.

Specific Caloric. Equal volumes of the same body at the same temperature contain equal quantities of Caloric — but equal volumes of different bodies at the same temperature may contain unequal quant^s. of Caloric. The quantity of Caloric which one body contains compared with another, is its Specific Caloric and the power of containing it its Capacity for C.

Comparative heat of bodies is the degree of heat necessary to raise bodies of equal volumes to an equal temperature — If we take two portions of water one heated to 200° the other to 100° & we mix them together the temperature of the whole will be the medium 150 this is not the case when we take bodies of different specific Caloric — thus if mercury at 100 & water at 60° the water will only gain one degree the mercury will lose 29. The medium temp being 61.

If sulphuric acid & water be mixed the temperature is considerably raised from the sudden condensation — When muriatic acid gas is condensed in water a considerable evolution of heat occurs — When water is mixed with Quick lime the same occurs from the water becoming solid — Take a saturated solution of Glaubers salts, corking it tight whilst the water is boiling, a vacuum is produced — when air is admitted it immediately crystallizes and the thermometer rises to 74°.

Different bodies contain unequal quantities of Caloric under equal temperatures — thus Ice may be exposed to the heat of boiling water but until it is all melted will not raise the thermometer —

Water under the exhausted receiver when a vessel containing sulph: acid is placed to absorb the moisture — will first boil and afterwards freeze — Ether poured on the bulb of a thermometer sinks the mercury considerably. A great cold is produced when salts are rapidly absorbed, by their absorbing a quantity of heat to become fluid — Five ounces of Mur. Ammon: & Nitre — 8 oz Sulph: Soda — 16 oz of water produces a cold of 8°.

By the evaporation of the Sulphuret of Carbon the thermometer may be brought to Zero and under in air pump 85° below Zero.

II.—COMBINED CALORIC.

Caloric, when combined with bodies, may be considered in two points of view:

1st. As *Specific or Comparative heat.*—Meaning of these terms defined and illustrated by experiments.—*Capacity* of bodies for caloric.—Changes of temperature produced by the condensation or rarefaction of elastic fluids.—Bodies ignited by the mere condensation of air.

2dly. In the state of *Latent heat,* also called *Heat of fluidity.*—Is that which is absorbed by bodies during their fusion or volatilization.—Account of some of Dr. Black's original experiments on the subject.—Experimental illustrations.—Cold produced by evaporation.—Cold produced by the solution of salts.—Heat evolved during the crystallization of salts.—Lavoisier's *Calorimeter.*—Application of the doctrine of latent heat to a variety of natural phenomena and artificial processes.

Of *Steam* in particular.—Distinction between *Vapour* and *Gas.*—Estimate of the elastic force of vapour.—Temperature of steam raised by increase of pressure.—*Eolipile.*—Papin's *Digester.*—Application of steam to mechanical purposes.—Chemical history of the *Steam-Engine.*

lb of Nitr. Ammon. 1lb Water — 11° — Mercury may be frozen by a mixture of equal parts of Nitr. Ammon. and snow — 13lb of each freeze 56lbs of Mercury

Processes of *Distillation—Sublimation—Evaporation—Spontaneous evaporation—Hygrometer.*

[illegible] Whether heat may be considered as existing in bodies in a state of *Chemical combination,* forming a third modification of combined caloric? [illegible]

The extrication of heat by *friction* and *percussion,* not distinctly referable to any of the other modifications of caloric.

OF LIGHT.

Connexion between caloric and *Light.*—Nature of light.—Its *reflexion* and *refraction.*—Its *decomposition* into seven coloured rays.—These rays differ in their power of producing light.—They differ also in their power of producing heat.

Property of certain bodies to absorb light.—*Phosphorescence.*—Bolognian stone.—Canton's phosphorus.—Animal phosphorescent substances.—Luminous fish.—Glow-worm.—Lantern fly.—Rotten wood.

Connexion of *Light* with *Oxygen.*—*De-oxydating* effects of light.—Its effects on nitrat and muriat of silver.—Mr. Wedgwood's contriv-

Distillation is a process of evaporation & condensation - for this the still is used - Wolf's Apparatus for particular substances 1st bottle is empty to receive fluids that may be condensed the second with water and potash to absorb gases and in the other any thing that will absorb the particular fluid we are conveying - Sublimation is the raising of volatile substances into the upper part of the vessels in which they are enclosed by heat.

The phenomena of Clouds and rain are accounted for by evaporation going on from the surface of the earth and being effected, & the clouds & fogs are the consequences of their condensation.

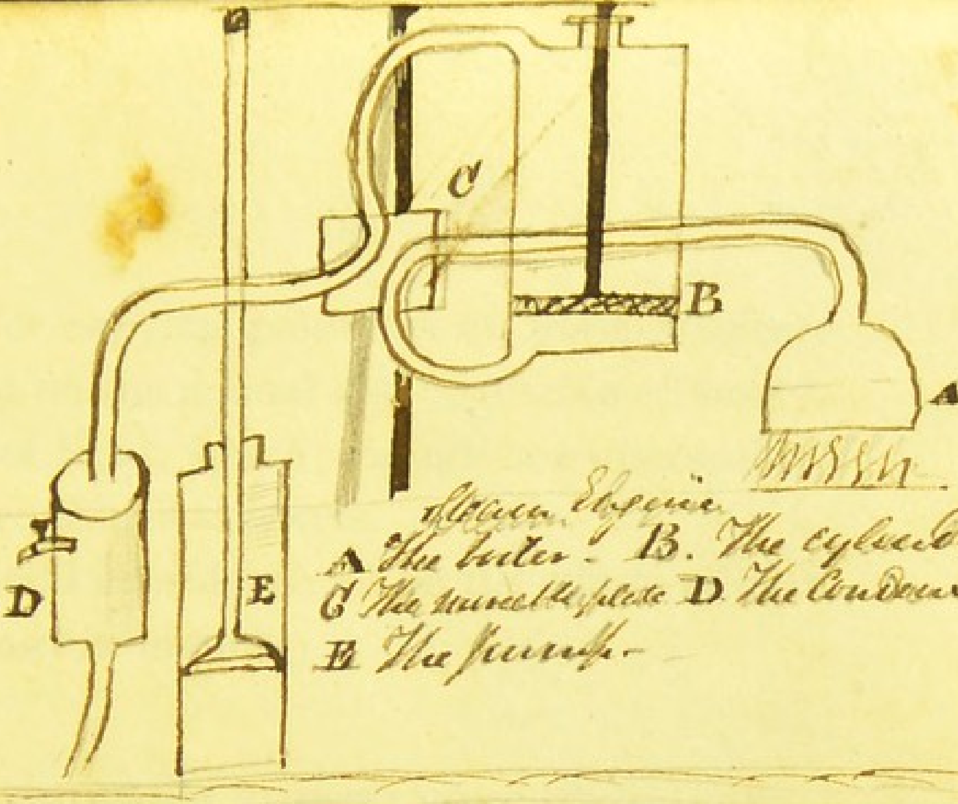
Light is infinitely small - is refracted and reflected by heat - Newton considered it as consisting of luminous particles & proceeding in straight lines from the sun travels at the rate of 164000 miles in time and is 8.4 minutes coming from the sun 90 millions of miles.

It may be decomposed into seven different rays Violet - Indigo - Blue - Green - Yellow - Orange - Red by the prism - Red is the least refrangible and Violet the most - Yellow illuminates the most and violet the least - Red is the warmest and this decreases to the violet.

A diamond exposed to the sun, and immediately covered with black wax - shone in the dark when the wax was removed after some months - Such bodies are called Solar Phosphori - [illegible]

The elastic power of steam is enormous. 1 cubic inch of water converted into steam will will raise 77,000 lbs while gunpowder will only raise 30,000 lbs — If vessels could be made strong enough to confine steam, water might be welded red hot; on this principle is Papin's digester where water may be heated to 400°. The steam engine was first invented by a Marquis of Worcester, and was improved on by Newcomen & Savery

Deoxidizing rays are just beyond the violet end of the spectrum & the power of changing fresh precipitated [illegible] silver. Heat is least at the red end and increases to the violet end of the spectrum but is greatest beyond it. So that there are 3 kinds of rays — of light — of heat — and deoxidation. Gum guiacum which changes from a yellowish colour to green on exposure to light — which has been attributed to the absorption of oxygen — becomes green beyond the violet — and returns to yellow at the other end.



Steam Engine

A The boiler. B. The cylinder
C The moveable plate D The condenser
E The pump.

The pressure of the Atmosphere is equal to 15 lb on every Square inch.

the standard 60. F. 30. B. Air every degree of F. expands 480th of its bulk.

60 F. 50 10 Diff.	480 | 1000 | 0,208 160	0,208 10 2,08.	as 30 : 2 100 2,08 102,08

as 30 : 29 :: 102,08
29
91872
20416
30 | 2960,32
98.6

100. Cubic inches at the standard pressure & Temper

of Atmospheric	31 grs.	Nitrous Oxide	50,5
Oxygen	33,8	Carbonic Acid	47,7
Azote	30,4	Muriatic Acid	47,7
Hydrogen	2,25	Sulphurous Acid	77,
Heavy Carbur. Hydro.	27,5	Nitric Acid Gas	76,
Nitrous Gas	33,5	Ammoniac. Gas	18,65

Procured either from Oxyd of Manganese or from Oxy-muriate of Potash thus this Weight 1 gr. equal 1 cubic inch ance for copying paintings on glass.—Effects of light on the animal and vegetable economy. Rays of light, which, though not discernible, produce chemical effects.

General considerations on the effects of HEAT and LIGHT in nature.

OF AERIFORM SUBSTANCES OR GASSES.

These consist of a solid ponderable substance or *Base* combined in a peculiar manner with *Caloric*.

The property of the resulting gas depends upon the nature of its base.

Those not condensable at common temperatures, distinguished by the name of *Permanently elastic Fluids*.

Method of ascertaining the *absolute* and *specific Gravity* of gasses, and computing their volume under different circumstances of *Pressure* and *Rarefaction*.

Elasticity of the air.—Theory of the *Air-Pump*.

Of Oxygen Gas.

Called formerly *Dephlogisticated, Pure, Empyreal,* or *Vital Air*.

Somewhat heavier than common air.—100 cubical inches at the temp. of 60 *Far.* and at 30 inches *Bar. press.* weigh about 33,8 grains.

Forms a constituent part of the *Atmosphere*—Serves the purposes of *Respiration* and *Combustion* in an eminent degree—Has a powerful affinity with a great variety of substances, particularly inflammable bodies, and when the new compounds are rapidly formed, *Caloric* and *Light* are frequently elicited.

Theory of *Combustion*—*Pyrophorus.*

To *Sulphur, Phosphorus,* and *Charcoal,* in the act of burning, it communicates *acid* properties; which are more or less distinct, as the combustion or decomposition of the Gas has been more or less complete.

The basis, therefore, of this fluid was formerly considered as the universally *Acidifying Principle,* and hence denominated *Oxygen*:—hence also the terms *Oxyd, Oxydation, Oxygenation,* &c.

The base of *Oxygen Gas* has a strong attraction for *Caloric,* but this is overcome or modified by the attraction of the particles of some solid substances.

It destroys the splendour and tenacity of the *Metallic Bodies* when they are exposed to it at permanently elastic. Atmospheric air 21 Oxygen 79 Azote

Gold and Platina very difficult to oxidize

Lead does not oxidise deep in its substance

Some oxides assume different colors according

to their different degrees of oxidation – thus

[illegible] – Yellow –

Respiration – Some English philosophers, [illegible]

[illegible] that the air was altered – but Priestly

and Scheele – the former found that an animal

died when confined in air – although there was

no diminution of volume – the air generally unfit

[illegible] unable to support combustion – [illegible] before

[illegible] per [illegible] should [illegible] in this way –

the same change takes place in combustion [illegible]

respiration. Carbonic acid is formed – of which

[illegible] lime water it becomes turbid – [illegible]

Oxygen will support life – Oxygen alone [illegible]

unfit to support life, and an animal dies

in [illegible] The structure of the lungs [illegible] known

[illegible] [illegible] [illegible] is brought [illegible] as to

[illegible] united with Oxygen – Philos. Exped.[illegible] 1809

[illegible] Allen & Pepys tried [illegible] experiments

found that there was a loss of Oxygen gas which

is exactly replaced by Carbonic acid – and no

[illegible] takes place – A [illegible] [illegible]

[illegible] that it might be accounted for – 32 [illegible]

Carbon. Acid in a minute [illegible] formed and the

solid Charcoal which it may contain [illegible] 16 grs

[illegible] sleep, less is produced

If there is a diminution of respiration, there is an alteration of its products - Nitrogen gas appears to be formed - and oxygen disappears. During the formation of Carbonic acid - Caloric is evolved

While Animals are ~~forming~~ forming Carbonic Acid gas, Vegetables are decomposing them. Oxygen gas may be procured from black Oxide of Manganese, by adding Sulphuric acid - from Nitrate of Potash heated in a retort - or from Oxydes. Atmosp

from *Atmospherical Air,* by exposure of the latter to *Sulphuret of Potash,* to a mixture of *Iron Filings* and *Sulphur,* &c.

Obtained also by mixing *Oxymuriatic Acid* with *Ammoniacal Gas.*

When pure has a faint smell, but no taste, and is rather lighter than *Atmospherical Air.*

100 cubical inches, *Therm.* 60° *Bar.* 30° weigh about 30,4 grs.

If inspired is instantaneously destructive of animal life; and extinguishes flame; but does not impede *vegetation.*

Differs from most other *Gasses* in being but in a small degree capable of absorption by *Water,* or by either of *Acids* or *Alkalies* in the liquid form.

Evolved in the decomposition of *Animal* and *Vegetable Substances,* of which it forms a constituent part.

When mixed in a certain proportion with *Oxygen Gas* and exposed to the *Electrical Spark,* it produces *Nitric Acid*; and by union with *Hydrogen Gas* it forms *Ammonia*—from the former of these properties it takes the name of *Nitrogen.*—Combined with *Chlorine,* it forms a siugular and very explosive compound.

Of the means thought to be employed by

obtained by the combustion of Phosphorus in
atmospheric air - By the Alkaline Sulphurets
which combine with the oxygen and leave the
azote - The best method is oxy the green sulphate muriate of Iron
saturated with Nitrous gas which it has a great
power of absorbing - it has then a great power
of attracting oxygen -
Azote is obtained by putting Nitric acid
diluted with 10 times its weight of water into a
vial add to it some muscle or flesh & apply a
little heat - some Nitrous gas may come over
which will be taken away by exposing the product
to a solution of green Sulph: of Iron - never seen
in a solid state -
When Chlorine is exposed to a solution of Nitrate
of Ammonia - decomposes the ammonia - and
forms a brown oil which is excessively explosive
- touch a drop when touched by any combustible,
it will break a basin to atoms altho' this
done under water -

Detonates when mix'd with Atmospheric Air. An animal will live in a mixture of this gas with Oxygen but with nitrogen & [illegible] is black-nature to maintain a due proportion between this and *Oxygen Gas* in the composition of the *Atmosphere.*

Of Hydrogen Gas, or Inflammable Air.

Found in a disengaged and impure state in *Coal Mines,* on the surface of *Stagnant Waters,* and rising through the waters of certain *Springs.*

Obtained also artificially in the state of *carburetted hydrogen,* from *animal, vegetable,* and *bituminous* matter by distillation; from *Essential Oils, Alcohol, Æthers,* &c. by the application of heat.

But purest from the decomposition of *Water* by *Metals,* as above stated; or during their solution in *diluted Acids;* or from *Ammoniacal Gas* by means of the *Electric Spark.*

When pure, between 11 or 12 times lighter than *Atmospherical Air:* hence the construction of *Aerostatic Machines.*

Smell adventitious.

100 cubical inches at a Temp: 60° *Farenht.* and 30 inches *Bar. press.* weigh 2.8 grs.

Combined with *Oxygen* in the proportion of about 12 *Hydrogen* to 88 *Oxygen* by weight, it forms water, from the decomposition of which these fluids may be both obtained in a gaseous state, and therefore considered as its elements.

Hence the effects of *Water* in promoting *Combustion*, and in the *Oxydation* of *Metals*, &c. &c.

In the combustion of *Hydrogen* with *Oxygen Gas*, the purity of the resulting water depends on the slowness or rapidity with which the process is conducted.

On inspiration proves noxious to *Animal life*, apparently by the exclusion of the *respirable* part of the *Atmosphere*.

In its nascent state it is found to be capable of combining both with *Oxygen* and *Azote*, with the one producing *Water* as in the case of combustion, and with the other *Ammonia*.

Forms an Acid Gas with *Iode* or *Iodine*.

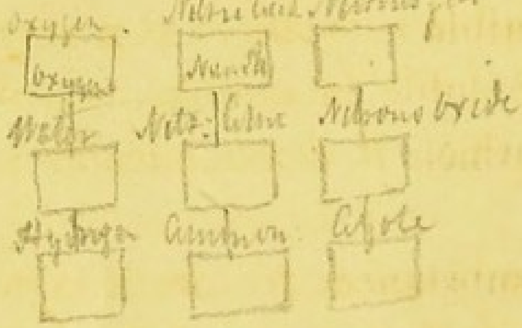
Carburetted Hydrogen Gas—formerly called *Heavy Inflammable Air*—procured by passing *Hydrogen Gas* over red hot *Charcoal*—afforded by subjecting *vegetables* and *Inflammable Substances* to a strong heat—different kinds of *Carburetted Hydrogen*—*Olefiant Gas*—*Gas Lights*. *Fire damp*—Sir H. Davy's *wire-gauze safety Lamp*.

Sulphuretted Hydrogen Gas—Methods of procuring—Combines with *Alkaline Bases*—Is absorbed by water—The solution precipitates some metals and not others.

Olefiant Gas made by putting some spirit of wine in a retort and

Enclose common pit coal in closed iron vessels, an empy-reumatic oil is received in the first vessel, while the gas passes thro' another vessel of lime water, to take up any carbonic acid that there may be in it

In coal mines carburetted Hydrogen is
produced. To obviate this Sir H. Davy's lamp.


Oxygen
Nitric acid
Nitrous gas
Oxygen
Water
Nitrous oxide
Hydrogen

Phosphuretted Hydrogen Gas—One of the most combustible substances known—Absorbable by water—Methods of procuring.

Hydrogen Gas is capable of holding *Arsenic* in solution.

Of Nitrous Oxyd Gas.

Procured from the decomposition of *Nitrate of Ammonia* with a gentle heat. Consists of *Oxygen* and *Azote* in intimate union. In some of its properties resembles *Acids.*

100 cubical inches at a middle temperature and pressure, weigh about 50 grains—Is decomposed by combustible substances at a very high temperature—Soluble in double its volume of *Water,* to which it communicates a sweetish taste.

Most inflammable substances require a high temperature to burn in it—Is not acted upon by *Nitrous Gas.*

Remarkable for the intoxicating effects which it produces in respiration.

OF SALTS.

These characterized by being *sapid* or of a *saline taste* and readily *soluble* in water; farther remarkable for their disposition to act on, or to be acted upon by most other substances, as also for the regularity of the forms which they are in most instances found capable of assuming—*Crystallization.*

Their solution in water for the most part accompanied by a diminution of temperature; hence the usual means of producing *artificial Cold.*

On exposure to air generally either receive or impart moisture: hence said to be *deliquescent* or *efflorescent.*

When heated, the greater number undergo either *watery* or *igneous Fusion*—some are volatilized, and many more or less completely decomposed.

They are divided into *simple* and *compounded*—the more simple are *Alkalies* and *Acids*—the compounded, such as result from the union of these with each other, *Neutral Salts,*—or of the acids with earths and metallic oxyds, *Earthy* and *Metallic Salts.*

We may know when the evaporation has been carried far enough by small pellicles forming on the top of the fluid.

Paper dipped in a decoction of turmeric is a test of the presence of an Alkali - Litmus paper for acid

Alkalis change turmeric paper red - and syrup of violets green -

To a solution of Muriate of Iron add a solution of ~~Glaubers Salts~~ Soda or Potash - the Iron is precipitated -

Potash obtained from the combustion of vegetables. therefore called vegetable alkali.
The Soda the mineral, from its being found in the earth.
The Ammonia i.e. the animal Alkali being obtained from the Animal kingdom -

OF ALKALIES.

Distinguished by a pungent, and lixivial or urinous *Taste,* and by changing most vegetable *blue* colours to *green,* and many of the vegetable *yellow* colours to *brown.*

Have a strong attraction for *moisture.*

Produce no alteration on each other, but manifest an extensive disposition to unite with other bodies. With *Acids* they constitute *Neutral Salts.*

They precipitate from their solutions most of the *Earths,* and all the *Metallic Oxyds,* several of which they are capable of re-dissolving.

With *unctuous substances* they form *Soaps*; with *Silex* and *Alumine* various kinds of *Glass* and *Porcelain*; with *Sulphur, Alkaline Hepars* or *Sulphurets.*

The substances most perfectly *Alkaline* are *Potash, Soda,* and *Ammonia.*

The two former, till lately, considered as simple bodies, but discovered by Sir H. Davy to consist of peculiar *Metallic Bases,* combined with *Oxygen.*

Ammonia remarkable for its volatility in a moderate temperature— a compound of *Hydrogen* and *Azote*.

Many of the *Earths* also have distinct alkaline properties, more especially *Barytes, Strontian* and *Lime*.

Of Potash.

Form, *concrete*. Taste, *extremely pungent, caustic*. Colour, *white*. When perfectly dry, is a non-conductor of *Electricity*. In this state consists, according to the experiments of Professor Davy, of a peculiar metal *Potassium*— combined with *Oxygen* and a portion of *Water* intimately combined.

Potassium is considerably lighter than *Water*—rapidly absorbs *Oxygen*—is capable of two states of oxidation, *Protoxyd* and *Peroxyd*—exists in the latter state in *Potash*—is soluble in *Hydrogen Gas*—combines with inflammable substances—and forms alloys with metals.

Potash appears to be a constituent part of most *vegetable* substances; it is also found to enter into the composition of several *minerals*. Usually obtained from the ashes of the former in the state of *common Potash*, by elixation in water and evaporation to dryness; or in that of *pure Potash* by subsequent treatment with *Lime*.

Potash is made in Russia & Germany by burning wood, the branches of trees yield more than the trunks the ashes are washed and the solution evaporated.
brown colour - [illegible]
Pearlash is made by breaking the Potash into small pieces exposed to considerable heat, and a current of air suffered to pass over it, the oxygen of air unites with the impurities the oleaginous and some of the carbon of the potash and leaves a substance perfectly white, ~~which~~ is pearlash - potash united with a greater proportion of Carbonic acid than before and freed from its impurities.
Potash is obtained free from Carbonic acid by mixing its solution with lime, the Carbonic acid unites with the lime and leaves the common Kali purum of the shops - but this is not perfectly pure, for chemical experiments this should be dissolved in pure Alcohol, which will only dissolve the Potash pure & will leave behind all the carbonate, or sulphate that may be contained. The Alcohol may be distilled off in a silver vessel covered with a glass alembic, and subjected to the igneous fusion while it will be quite clear, and the residuum is an Hydrate of Potash
Potash composed of 16 oxygen - 84 Potassium
Specific gravity lighter than water

Has a strong attraction for *moisture.*

On solution in *Water* produces an increase of temperature (*Liquor Potassæ* P.L)

Combines with all the *Acids,* and in most instances with a force of attraction superior to that of any other substance.

Fusible in a moderate, and volatile in an intense heat. Is decomposed in a high temperature by *Iron.*

Promotes the fusion of *earthy Bodies* and of *metallic Oxyds*; hence the preparation of different kinds of *Glass.* Unites with *Sulphur,* and renders it soluble in water (*Potassæ Sulphuratum* P.L.)

Dissolves several of the *Metallic Oxyds.* The comparative forces of attraction under all circumstances by no means exactly ascertained.

The order of the attraction of this alkali, in the moist way, *Sulphuric, Nitric, Muriatic, Phosphoric, Fluoric, Oxalic, Tartaric, Arsenic, Succinic, Citric, Lactic, Benzoic, Acetic, Boracic, Sulphureous, Carbonic and Prussic Acid*; *Water, Unctuous Oils, Sulphur, Metallic Oxyds*; in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Nitric, Muriatic, Fluoric, Succinic, Formic, Lactic, Benzoic,* and *Acetic Acid, Barytes, Lime, Magnesia, Alumine, Silica, Sulphur.*

Sometimes prescribed internally in solution; in the concrete form frequently employed as a *Caustic.*

Of Soda.

Its *Form, Colour, Taste, Causticity,* &c. nearly the same with those of the former *Alkali.*

Consists, according to Sir H. Davy, of a peculiar *metallic Base* called *Sodium,* combined with *Oxygen.*

Sodium lighter than water, but heavier than *Potassium.* Other particulars in which these two metals differ.

Found in great abundance in the mineral kingdom, particularly in combination with *Muriatic Acid.*—Obtained, in a pure or caustic form, from *Carbonate* of *Soda,* by means of *Lime,* as pure or caustic *Potash* is from *Carbonate of Potash.*

Soda has an equally extensive disposition to combine with *Acids* as *Potash.*

Acts powerfully on the *Earths* and *metallic Oxyds*; also unites readily with *unctuous substances*; hence the preparations of *common Soaps.*

Order of attraction of this Alkali, the same as that of *Potash.*

Soda is obtained by burning sea-weed -
and is brought to us under the name Barilla - carbon-
carbonate of soda - mixed with the Muriate
Barilla is of a grey colour.

An alloy of Sodium and Potassium is lighter
than the previous weight of both.
Nitro-muriate of Platina precipitates in a solution
of Potash, but does not with Soda.
Tartaric Acid Chrystalizes with Potash but not
with Soda

Ammoniacal Gas may be decomposed by
e Electric spark, dividing it into Hydrogen
d Azote.
may judge of the strength of a Liquor Ammon.
the lightness of the liquor, the lighter, the stronger.
oduced by the decomposition of Animal Matter
Hartshorn is merely Ammonia, with an
mpyreumatic oil.

Of Ammonia.

Form, *gaseous.*—Smell extremely *pungent.*—*Caustic.*—*Azotic.*—Lighter than *Atmospheric Air*—100 cubic inches weigh 18,67 grains—Experiment of Professor Berzelius, tending to show its metallic basis.

Is absorbed both by *Water* and *Alcohol;* by the former with great rapidity, producing an increase of temperature and bulk *(Liquor Ammoniæ* P.L.*)* On the contrary, *Ice* dissolved in this fluid, produces cold.

Is in a slight degree *inflammable.*

Obtained from the distillation of *bones* and other kinds of *animal Matter,* but purest from the decomposition of *Muriate of Ammonia,* by *Potash, Soda,* or *Lime.*

May be decomposed in various ways; as by exposure to *Heat,* by the *Electric Spark,* in the reduction of *Metallic Oxyds,* by the distillation of *Nitrate* of *Ammonia,* &c. yielding in some cases *Hydrogen,* in others *Azotic Gas:* which gasses by particular modes of combination have been found to reproduce it, and are therefore considered as its elements.—Appears to contain *Oxygen,* and to have a *Metallic base* like the other Alkalies.

Agrees nearly with the other *Alkalies* in the order of its attraction, both in the humid and dry way.

OF ACIDS.

Appear in general to consist of *Combustible Substances* in union with the base of *Oxygen Gas,* the proportion of which in most cases determines the degree of *Acidity.*—A few of the acids, such as the *Prussic,* do not contain oxygen.—Several of them the immediate result of *Combustion.*

Distinguished by being *sour* to the taste, changing vegetable *blue* colours to *red,* and by their extensive power of combining with other substances.

The properties of the individual *Acids* dependent on the nature of their respective *Bases,* &c: the stronger the attraction of their Bases for *Oxygen,* the less intense in most instances their *Acidity.*

All unite readily with water. *Diluted Acids.*

In combination with *Alkalies* form for the most part what are called *Neutral Salts*; with *Earths* and *Metallic Oxyds, Earthy* and *Metallic Salts.*

Eau de Luce - M. of Liq: Ammon: ʒij Ol.
40. M. Lavand;

the proportion of the compounds in Dry
Sulphuric acid – 40 Sulphr – 60 Oxygen –
In the Liquid – 32,62 Sulphr. in 100 parts
40,41 Oxygen
16,47 Water.

Most of the acids *antisceptic*. Some powerfully *corrosive*.

Admit of different distinctions—from their form, into *solid, liquid,* and *gaseous*; from their more usual and abundant sources, into *mineral, vegetable* and *animal*; into such as have *simple*, and such as have *compounded* bases.

The more important of the *Acids* are, the *Sulphuric, Nitric, Muriatic, Carbonic, Fluoric, Boracic, Acetic, Tartaric, Oxalic, Citric, Gallic, Phosphoric* and *Prussic*.

Of Sulphuric Acid. Sp. Gr. 1.850

Formerly called *Acid, Oil,* and *Spirit of Vitriol*.

Long considered as the *Universal Acid.*

Never found free from water, and seldom uncombined.

Obtained artificially from the rapid combustion of *Sulphur*, or of a mixture of *Sulphur* with *Nitre*, or from the distillation of *Sulphate of Iron*.

Concentrated afterwards by *boiling*.

When pure, *limpid, ponderous, unctuous, inodorous,* and intensely *sour*.

Specific gravity nearly double that of *Water*.

Has a powerful attraction for *Moisture*, and on mixture with *Water*, occasions a remarkable increase of temperature.

When volatilized by the higher degrees of heat, it assumes the form of a dense white vapour, the first portions of which sometimes congeal if exposed to a moderate cold. *(Glacial Oil or Acid of Vitriol.)*

By treatment with *Combustible Substances* is generally more or less discoloured, and may be either deprived of a portion of its *Oxygen,* and thereby made to assume the form of *Sulphurous Acid Gas,* or totally decomposed and reduced to its original basis, *Sulphur.*

The properties of *Sulphurous Acid Gas,* which may be also prepared by the *slow* combustion of *Sulphur,* in many respects different from those of the *Sulphuric Acid;* its compounds therefore differently denominated. *Sulphite of Potash,* &c.

The *Sulphuric* superior to most *Acids* in its *Power* of *Attraction* for other bodies.

Independently of its *Water,* supposed to consist of 40 parts of *Sulphur* and 60 of *Oxygen.*

The order of its attraction *Barytes, Strontian, Potash, Soda, Lime, Magnesia, Ammonia, Alumine, Metallic Oxyds, Water, Alcohol.*

Combined with *Alkalies* it forms:

1st, *Sulphate of Potash* (*Potassæ Sulphas* P.L.) usually prepared from the saline mass which remains after the distillation of *Nitric Acid.*—

...cetate & Muriate of Baryte tests of the presence
Sulph: Acid - forms an insoluble Sulph: Baryt.

Pearlash may be obtained from the Sulphate of Potash

Sulph: Acid: Sulphur × Carbon | Carb. of Potash
Oxygen × Potash |

A Sulphuret of Potash is obtained by using Carbonate of Lime. another decomposition takes place

Sulph. Potass: Potash × Lime | Carb. Lime
Sulphur × Carbon C. |

Form, hexangular prisms with hexahedral pyramids--prism frequently wanting.—Taste, *saltish bitter*.—Difficulty soluble in water; also very difficult of fusion—May be decomposed either in the *moist* way by *Barytes*, or in the *dry* way by calcination with *Charcoal*.—100 parts consist of 42,2 of *Sulphuric Acid*, 50,1 of *Potash*, and 7,7 of *Water*—Application chiefly *medical*.

Super Sulphate of Potash—crystallizes in slender needles or hexangular prisms—soluble in five parts of water, contains twice as much acid as the sulphate. (*Potassæ super Sulphas* P.L.)

2d. *Sulphate of Soda* (*Sodæ Sulphas* P.L.) obtained by solution and crystallization from the matter left behind in the preparation of *Muriatic Acid*, *Muriate of Ammonia*, or *Muriate of Quicksilver*. Is also found native in many mineral springs. Form of its crystals, *hexangular prisms with dihedral summits*.—Taste, bitter.—Effloresces on exposure to *Air*.—Readily soluble in *Water*.—When exposed to *Heat*, undergoes watery fusion. May be decomposed in the same way as *Sulphate of Potash*.—100 parts consist of 23,52 *Acid*, 18,48 *Soda*, 58 *Water*.—Used only in *Medicine*.

3d. *Sulphate of Ammonia*, obtained by the union of *Sulphuric Acid*, with *Ammonia*, on the addition of diluted *Sulphuric Acid* to liquid *Carbonate of Ammonia.*—Form, *crystalline.*—Taste, bitter pungent.--Easily soluble in *Water.* Fusible. Volatile.—Employed principally in the manufacture of *Muriate of Ammonia.*

Sulphuric Acid forms also with the *Earths* and *Metallic Oxyds*, particular compounds, to be hereafter spoken of under their respective heads.

Employed principally in *Dyeing, Bleaching, Tanning, purification of Oils*, and *in Medicine.*

Of Nitric Acid.

The basis of this *Acid* is *Azote*—consists of *Nitrous Gas* or *Nitric Oxyd*, and *Oxygen.*

100 parts of *Nitrous Gas* consist of 46,63 *Azote*, 53,37 *Oxygen.*—100 cub. inches weigh 32 grs. Partly absorbed by *Water*—effects on animals—and on combustible substances—decomposed by the *Electric Spark*—also by *Sulphurets* and some of the *Metals*—means of procuring—test of its purity—reproduces *Nitric Acid* by the addition, and furnishes pure *Azote* by the substraction of *Oxygen.*—100 parts of dry *Nitric Acid* said to consist of 55.6 *Nitrous Gas* and 44,4 *Oxygen*—or about 26 *Azote*, and

Nitrous acid obtained by decomposing
ric acid by means of copper
Sullivt — contains 40° of strong Acid. Sp. gr. 1,300
50 do — 1,45
60 — 1,600
Aq: Fortis of the shops is 1 in 4 of water
It is completely volatilized from tube
by evaporation freed from Sulphuric acid by
ate of barytes — from Muriatic by Nitrate of Silv.
the muriatic acid uniting with the oxyde of silver
forms an insoluble compound — and by putting
the Nitr. Acid — and crystals Nitre in to the acid
distilling it, it comes over perfectly pure

74 *Oxygen.* — *Nitric Acid Gas* rapidly combines with *Water* and forms *liquid Nitric Acid.* —100 parts spec. grav. 1,5 consist of 75 *Acid* and 25 *Water.*

Obtained from the decomposition of *Nitrate* of *Potash* by *Sulphuric Acid,* or by *Sulphate* of *Iron.*

Purified by re-distilling it from a fresh portion of *Nitre,* or by the addition of *Nitrate* of *Silver* and of *Barytes.*

In its common form, of a yellowish or orange colour: when pure, altogether colourless.

More volatile and less ponderous than *Sulphuric Acid*—its acidity equally intense—attracts moisture also from the atmosphere. (*Acidum Nitrosum dilutum* P.L.) *Aqua-fortis.*

Destructive, more immediately than the *Sulphuric Acid,* of the life and texture of bodies to which it is applied.

On mixture with *Sulphuric Acid* communicates to it the property of dissolving silver: *Aqua Reginæ.*

Experiments of Cavendish and Milner on *Nitric Acid*—its spontaneous production by processes of nature.

This Acid dissolves all the *Earthy Bodies* except *Silica.*

In its action on the *Metallic Bodies*, it is decomposed to a greater or less degree according to their capability of uniting with a larger or smaller proportion of its *Oxygen*.

Similar effects produced on it by *Charcoal*, *Phosphorus*, *Sulphur*, and most other combustible substances; as also by exposure either to *Light* or *Heat*.

Hence the difference, if any, between *Nitrous* and *Nitric Acid*, and the formation of *Nitrous Gas*, and *Nitrous Oxyd*.

In some instances, the reciprocal action is such as to occasion immediate inflammation, as on mixture with *Essential Oils*.

Combined with *Alkalies* it forms,

1st. *Nitrate of Potash* (*Potassæ Nitras* P.L.) Obtained in the East Indies and other countries, by the elixation of certain soils, in which it is either spontaneously and repeatedly produced by their exposure to Air and Light, or formed upon the addition of *Potash*.—Those soils more especially productive which abound in vegetable and animal matter that has run into a state of putrefaction.—Freed from extraneous saline matter by repeated crystallization.—Form of its crystals prismatic.—Taste, cold, saline, penetrating.—Much more soluble in itrate of

Nitrates may be known by their deflagration
with Charcoal

The Mixture of Gunpowder consists of 75 parts
Nitrate of Potash - 15 Charcoal - 10 Sulphur.
Its quality depends on the purity of the ma-
terials - sometimes the nitre contains a large portion
of Mur: Sodae, these must be got rid of by
solution & Crystallization - owing to
its diminished solubility. Nitre must then
be ground fine - the charcoal cylindrical the
best - Sulphur purified by melting & skimming
the above portions are then mixed together & are
moistened with water (about 3 pr cent) & ground under a stone runner
when it becomes an uniform mass it is perfectly
dried, and passed thro a parchment sieve with
lignum vitae runners - the fine portions are then
separated by sieving and dried in a room heated
by steam - [illegible] reproduced - the residuum is a
sulphuret of Potash - proved by its taking fire at
a moderate distance - and not burning holes in
a sieve.

hot than in cold water.—In a moderate heat it undergoes fusion *(Salprunellæ)*.—An increase of the heat produces a decomposition of its acid, the *Alkali* remaining unchanged.—May be more rapidly decomposed by the addition of *Charcoal*; hence the preparation of *Gun-powder*.—When decomposed in the moist way, by treatment with the *Sulphuric*, furnishes *Nitric Acid*.—100 parts of this salt in the state of dryness, consist of 53 of *Nitric Acid*, 47 of *Potash*.—Used extensively in *Glass-making*, *Metallurgy*, preparation of *Gun-powder*, and for *dietetic* and *medical* purposes.

2d. *Nitrate of Soda*, called formerly *cubical* or *quadrangular Nitre*. In most of its properties resembles the former.

3d. *Nitrate of Ammonia*; obtained by slow evaporation, from the combination of *Nitric Acid* and *Ammonia*.--Form, crystalline.--Taste, cool, bitter, urinous.--Deliquescent.—Easily fusible.—Under cautious distillation, yields *Nitrous Oxyd*, *Nitrous Gas*, and *Water*; but detonates when suddenly heated.

The *Order* of *Attraction* of this acid, the same as that of the *Sulphuric*.

Chief uses, in *Dyeing*, *Etching*, and *Assaying*; and sometimes employed in *Medicine*.

Of Muriatic Acid.

Obtained by decomposing *Muriate* of *Soda*, by means similar to those employed in the preparation of the *Nitric Acid*.

Its purest form *Gaseous*.

In this state heavier than *Atmospherical Air*; 100 cubic inches at mean pressure and temperature, weighing 39 grains; of a pungent odour; irrespirable; destructive of flame, imparting to it under extinction a bright green colour; inflaming the skin without discolouring or corroding it.

Formerly supposed to consist of an unknown radical intimately combined with *Oxygen*. Late researches of Sir H. Davy, by which this doctrine is controverted.

When dry has no action on the *Metals*, nor on any other of the *Combustible Substances*.

Exposed to a moist atmosphere it becomes cloudy—Is readily absorbed both by *Water* and *Ice*, the latter of which it liquefies: in either case it occasions an increase of temperature and augmentation of bulk, communicating to the water the general properties of an *Acid*) *Acidum Muriaticum* P.L.)

the 8 p^ts of Muriate of Soda - 6 P^ts of [illegible]
[illegible] - and in the second bottle of Woolf's apparatus
put as much water as there are parts of
muriate of Soda, water will absorb 400 times
weight of the gas produced, and an increase
temperature is produced, therefore the vessel
must be kept cool

great attraction for moisture

Sir H. Davy's calculation of the quantity
real acid. in a given specific gravity of the fluid

Sp. Gr. 1,210 contains 42
1,120 —— 24

Dr Henry endeavored to decompose it by
electric spark, and did not find he could
completely succeed.

/

Muriate of Soda in the common way
is adulterated with muriate of Magnesia,
is being separated with Sulphuric acid
it is decomposed, and the sulph. magnesia
Epsom Salts are obtained. This is the way the
most of this salt is obtained
Sulph. Magnes. — Sulph. Acid. are also found
in the Bay Salt is that where as they salleys
in the ponds into which it is admitted previous
to its being placed in the boilers. The liquor is
admitted to the pond that it may be partially
evaporated by the Sun.
Take 4 oz. of litharge finely powdered litharge
— muriate of soda in solution the
muriatic acid goes to the lead and forms
patent yellow — while the soda is obtained from
the soda and carbonic acid

Muriatic Acid dissolves also some of the *Metals,* as *Zinc* and *Iron,* with the production of *Hydrogen Gas;* and shews a superiority of attraction for most of the *Metallic Oxyds.*

In its liquid and more common form it readily dissolves and unites with all the *Alkalies* and most of the *Earths.*—Its combinations with the former are,

1st. *Muriate of Potash,* formerly called *Salt of Silvius;* a salt but little used.

2d. *Muriate of Soda (Common Salt);* obtained by evaporation from *Sea Water,* or the water of *salt Springs,* or the solution of *Rock Salt,* which is found in several parts of the world in immense quantities.—Form of its crystals cubical.—Taste, agreeably saline.—Equally soluble in cold *Water* as in hot; sparingly soluble in *Alcohol.*—Crystals burst or decrepitate on sudden exposure to *Heat.*—Melt in a red heat without decomposition. May be converted into vapour by being intensely heated.—Promote the fusion of many of the *earthy* and *metallic* bodies.—May be decomposed in the moist way by *Sulphuric* and *Nitric Acids;* and in the dry way, by the *Phosphoric, Boracic,* and *Arsenic.* May also be decomposed by *Oxyd* of *Lead;* hence the preparation of *Turner's Patent Yel-*

low.—100 parts *Mur.* of *Soda* dried at a red heat, consist of 46 *Mur. Acid,* and 54 *Soda.* New views of Sir H. Davy on the constitution of this *Salt*—Other methods of procuring *Soda* from it—Its extensive application in *Agriculture, Glass-making, Glazing, Metallurgy, Soap-making, Diet, Pharmaceutic, Chemistry,* &c.

3d. *Muriate of Ammonia, (Ammoniæ Murias. P. L.)*; found native in the neighbourhood of Volcanos; prepared also, in large quantities, in the dry way, by double chemical affinity from a mixture of *Sulphate of Ammonia* and *Muriate of Soda.*—Form, concrete.—Taste, penetrating, acrid, urinous.—Soluble both in *Water* and *Alcohol.*—Crystallizes under evaporation into small quadrangular prisms.—Yields its basis readily to both the fixed alkalies, and to lime:—is also partially decomposed by sublimation with oxyd of iron. *(Ferrum Ammoniatum* P. L.)—Is of extensive use in *Dyeing, Tinning, Soldering,* &c. Used also frequently in *Medicine.*

The chemical affinity of the common form of the *Muriatic Acid* in most instances weaker than that of either the *Sulphuric* or *Nitric*; but the order of its attraction the same.

On mixture, either in the liquid or gaseous state, with *Nitric Acid,* occasions in it a partial

decomposition, and acquires new properties: *Aqua Regia* or *Nitro-Muriatic Acid.*

Of Oxy-muriatic Acid Gas, or *Chlorine.*

A substance analagous to *Nitro-Muriatic Acid,* is obtained by the action of *Muriatic Acid* on certain of the *Metallic Oxyds,* more especially on that of *Manganese:* hence the preparation of *Oxy-muriatic,* or as it was at first called, *Dephlogisticated Marine Acid.*

New views of Sir H. Davy on the Nature of this Gas—Experiments tending to prove that it is a simple substance—and if so, the present name improper—that of *Chlorine* adopted by Sir H. Davy.

The sensible properties of this Gas distinguishable from those of all the other Elastic Fluids—Remarkable for its effects both on *Animal* and *Vegetable Colours*—Thought to possess the important property of destroying *putrid* and *contagious Effluvia*—Not so readily absorbed by *Water* as *common Muriatic Acid Gas*—Is materially affected by exposure to *Light,* is readily acted upon by most of the *Metallic Bodies,* and, in several instances, produces appearances like actual *Inflammation.*

Much heavier than *Atmospheric Air.*—100 cub. inches weighing from 76 to 77 grs.

Ideas of Scheele on the constitution of this singular substance — Of Berthollet and the French Chemists — Of Dr. Henry— Important discoveries of Sir H. Davy ; reasons which induced him to doubt the existence of *Oxygen* in it—Curious effects on *Phosphorus*—Highly negative with respect to *Electrical energy*—Means of procuring.—Singular compound of this gas and oxygen.

Its combinations with salifiable bases (hitherto called *Oxy-muriates*) afford *Oxygen Gas* when heated ; triturated with combustible substances, they inflame and frequently detonate. The most important of these is, *Oxy-muriate of Potash,* obtained by cautiously evaporating and cooling a solution of *Potash,* saturated with *Oxy-muriatic Acid.* It crystallizes into flat hexahedral laminæ or rhomboidal plates of a pearly lustre : taste faintly saline : moderately soluble in *Water* : on exposure to heat readily undergoes watery fusion, and, like *Nitrate* of *Potash,* yields great abundance of *Oxygen Gas,* but of more than ordinary purity.—Much more remarkable than *Nitrate* of *Potash,* for its power of detonating on mixture with several of the

combustible bodies, as *Charcoal, Sulphur,* and *Phosphorus*; more especially the latter.

Of Iode, or *Iodine.*

Is a simple substance analogous to Chlorine: may be obtained by the action of Sulphuric Acid on the *mother-liquor* of solutions of *Kelp* or *Barilla.*—Its form is solid and crystalline, and its appearance metallic when cold; but at the temperature of about 350° passes to the state of a gas of a beautiful violet colour.—Forms an *Acid Gas* with *Hydrogen.*—Imparts a blue colour to solutions of Starch.

Of Carbonic Acid.

Called also *Aerial Acid,* and *Fixed Air.*

The natural forms and sources of this acid various. Results uniformly from the burning of *Charcoal.*

Usually collected in its gaseous state from bodies undergoing the *Vinous Fermentation*; or from *Carbonated Earths* or *Alkalies,* by the application of *Heat,* or more commonly by the addition of an *Acid* of superior attraction.

Specifically heavier that *Atmospherical Air*: hence so frequently found stagnant in *Mines, Caverns,* and other subterraneous situations.—100 cub. inches weigh 47.26 grs.

Instantaneously fatal when employed alone in Respiration; and equally incapable of supporting Flame.

Unites readily with *Water* at a middle temperature, communicating to it *acid* properties, and a consequent solvent power over other bodies: hence the nature and imitation of various *Medicinal Springs.*

Its combination with *Water* materially promoted by a diminution of temperature short of freezing, by agitation, and by artificial pressure.

Experiments on the constitution of this *Acid.*—100 parts by weight consist of 28.60 *Carbon,* 71,40 *Oxygen.*

Charcoal, not an *Oxyd* of *Diamond* as erroneously supposed.—*Carbon* can exist in two distinct states of *Oxydation.*—*Carbonic Oxyd,* and *Carbonic Acid.*

Carbonic Acid procured by exposing the *Oxyds* of *Metals* and *Charcoal,* or a mixture of powdered *Marble* and filings of *Zinc,* to a red heat.

Solution Potash Water — ʒi. of Carbonate to [illegible]

Stalactites are formed by springs water passing over [illegible] stone dissolving a portion of Lime, which is deposits as a carbonate of Lime & the water evaporates.

Lime, baryta, & strontian water are tests of the presence of Carbonic Acid — forming insoluble compounds.

combinations with carbonic acid

Stalactites formed by water passing over beds of carbonate of Lime then on the surface of caves &c it deposits tho' the water is exhausted and the carbonate deposited.

Pure ~~potash~~ Carbon that Hydrates may be obtained by coming potassium in Carbonic Acid gas.

the equal parts powdered Zinc & Charcoal, s
mix them, subject to a strong heat, and
suppose Carb: Acid to be Carbon united with
2 particles of Oxygen — one of these portions
united of
unites forming the oxyd zinc — and leaves the Carbon
in its first degree of Oxydation — Gaseous oxide
of Carbon — Charcoal — this burns in air &
absorbs Oxygen forming Carbonic Acid.

Should be soluble in twice its weight of water

Formerly considered as *Hydrogen Gas* holding *Carbon* in solution, and called by Priestly *Heavy Inflammable Air*, but proved by Cruickshank to be a distinct species, having *Carbon* for its basis combined with a limited proportion of *Oxygen*, inferior to that which constitutes *Carbonic Acid*.—100 cubical inches, middle temperature and pressure, weigh about 20 grs. —It is inflammable, and burns with a lambent blue flame, but does not explode with common air. And by combustion is converted into *Carbonic Acid Gas*

This acid, like others, is disposed to combine with salifiable bases. With *Alkalies* it forms,

1st. *Carbonate of Potash* (*Potassæ sub-carbonas* P.L.) usually obtained from the ashes of vegetables, by lixiviating them in water, decanting and evaporating to dryness.—Form, powdery.—Taste, urinous.—Colour, pearly-white.—Deliquescent in a moist atmosphere (*Liquor Potassæ sub-carbonatis* P. L.) May then be crystallized after cautious evaporation —May be decomposed in the moist way by most of the other *Acids*, or by *Lime*; and in the dry way, by the simple application of *Heat*. —Uses various, as in *Glass-making*, *Bleaching*, *Metallurgy*, *Medicine*, &c.

2. *Carbonate of Soda* (*Sodæ sub-carbonas* P. L.) found native in *Egypt*, the island of *Teneriffe*, and elsewhere; obtained also from ashes of certain marine plants, by elixation, evaporation, and crystallization.—Form of its crystals a rhomboidal octohedron—Effloresces on exposure to *Air*.—Its other properties and uses nearly similar to those of *Carbonate of Potash*.

3d. *Carbonate of Ammoniæ* (*Ammoniæ Carbonas* P.L.); obtained by distillation from most animal, and some vegetable and mineral substances: or from the decomposition of *Muriate of Ammonia* by *Carbonate of Potash*, or by *Carbonate of Lime*.—Form, concrete.—Smell, pungent.—Taste, urinous.—Very soluble in *Water* (*Liquor Ammoniæ Carbonatis* P. L.) With unctuous substances forms an imperfect *Soap* (*Linimentum Ammoniæ* P.L.) Like all the foregoing compounds, may be decomposed by *Potash*, *Soda*, *Barytes*, or *Lime*.

Carbonic Acid now universally considered as consisting of *Carbon* rendered acid by *Oxygen*; for which it has a stronger affinity than most other acidifiable bases.

Inferior to most of the *Acids* in its *Attraction* for other bodies.

Order of attraction, *Barytes, Strontian, Lime,*

Fluor Spar is [illegible] by means of Sulph. acid
decomposed [illegible] Fluoric acid [illegible]
[illegible] from
Fluate of Ammonia [illegible] Alum
Take 1 oz. [illegible] Boracic acid
2 oz Fluate of Lime
12 oz Sulphuric acid.

Potash, Soda, Magnesia, Ammonia, Alumine, Metallic Oxyds, Water, Alcohol. Uses chiefly *medical.*

Of Fluoric Acid.

Obtained by decomposing *Fluate* of *Lime* by means of the *Sulphuric Acid.*

Form gaseous.

Heavier than atmospherical air, Caustic.—Kills animals immersed in it.

Unites readily with *Water,* and renders it intensely sour.

In union with the *Alkalies,* forms compounds of a gelatinous consistence.

Possesses the remarkable property of dissolving and volatilizing *Silica.*

Dissolves *Zinc, Iron,* and *Copper;* the other metals not acted on, unless in the state of *Oxyds.*

Decomposed by Sir H. Davy by means of *Potassium.* Appears to consist of *Hydrogen* combined with a peculiar base—*Fluorine.*

Order of attraction, *Lime, Barytes, Strontian, Magnesia, Potash, Soda, Ammonia, Alumine, Metallic Oxyds, Water, Alcohol.*

Use—*Etching on Glass.*

Of Boracic Acid.

Called formerly *Sedative Salt.*

Form, concrete, scaly.--Semi-transparent and of a pearly lustre, and saline acid taste.

Sparingly soluble in *Water*; more so in *Alcohol,* to the flame of which it communicates a greenish tinge.

When united with *Water* easily sublimed.

Fusible without addition into a transparent *Glass.*

Decomposed by *voltaic Electricity,* but more completely by *Potassium*—*Boron,* or the basis of *Boracic Acid.* Experiments of Davy on this subject—Conjectures that this basis is *metallic.*

By combination with *Soda,* produces *Borate of Soda* (*Sodæ Boras* P. L); obtained in an impure form, from the spontaneous evaporation of the water of certain lakes in the kingdom of *Thibet*; said also to be found in those of *South America.* — Purified by subsequent solution, boiling, and crystallization.—Form of its crystals, prismatic.—100 parts consist of about 34 *Acid,* 19 *Soda,* 47 *Water.*—Taste styptic.—Readily soluble in hot water.—Changes vegetable blue colours to green.—When heated,

Sulphuric, Muriatic, & Nitric acid decompose
borate of Soda.

derately acid—May be concentrated by freezing—But most perfectly by combining it with a *salifiable base* and subjecting the compound to distillation—As *Verdigris*, or *Acetate* of *Potash* and *Sulphuric Acid*—Other methods—Sometimes called *Radical Vinegar*—Very acrid—Inflames the skin—Slightly inflammable—According to Gay Lussac consists of 44,15 *Oxygen*, 5,63 *Hydrogen*, 50,22 *Carbon*—*Aromatic Essence* of *Vinegar* combined with *Potash* produces *Acetate* of *Potash* (*Potassæ Acetas* P.L.); prepared by saturating *Potash* with *distilled Vinegar*, evaporating to dryness, melting the remaining mass, dissolving it in water, filtering and evaporating a second time.—Form, flakey.—Colour, white.—Taste, pungent.—Deliquescent.—Easily soluble both in *Water* and *Alcohol*.—Its acid decomposed in distillation.—Yields *Acetic Acid* on the addition of the *Sulphuric*.—Used in medicine as a *Diuretic*.

With *Ammonia* it produces, *Acetate* of *Ammonia* (*Liquor Ammoniæ Acetatis* P. L.); prepared by saturating distilled *Acetic Acid* with *Ammonia*.—Form, liquid.—Taste, urinous.—Employed as a *diaphoretic*; sometimes also used externally as a *discutient*.

Order of attraction, *Barytes*, *Potash*, *Soda*,

Potass: Supertart:
contains
Tartaric: Acid 2
Potash . 1

Carb: Calcis
contains
Carbonic Acid
Lime

Strontian, Lime, Ammonia, Magnesia, Metallic Oxyds, Water, Alcohol.

Of Tartaric Acid.

Obtained from *Acidulous Tartrate* of *Potash* by means of *Lime,* or *Carbonate* of *Lime,* and the subsequent addition of *Sulphuric Acid.* May also be prepared by the *Sulphuric Acid* alone.

Capable of forming regular crystals which assume various forms. Not altered by exposure to *Air.* Readily soluble in *Water,* and of an agreeably acid taste.

Easily decomposed by *Heat.*

Yields *Oxalic Acid* by treatment with the *Nitric,* and *Acetic* by digestion with *Water* and *Alcohol.*

Its more important saline compounds are,

1st. *Acidulous Tartrate of Potash,* prepared from *crude Tartar* (the spontaneous deposit from new wine) by solution and evaporation (*Potassæ super tartras* P. L.), or by crystallization under cooling.--Form crystalline.--Taste agreeably acid.—Of little solubility in *Water.* Decomposed by the application of *Heat;* its chief products, an *Acid liquor*, and *Carbonate* of *Potash*, which has therefore been called *Salt* of *Tartar*.—Of various application in the arts, as in *Tinning*, *Dyeing*, *Hat-making*; employed also extensively in *Medicine*.

2d. *Tartrate* of *Potash* (*Potassæ Tartras* P. L.); prepared from the solution of the former, either by precipitating its excess of acid by means of *Chalk*, or by saturating it with additional *Potash*—Form, crystalline.—Taste, saltish-bitter --Also very soluble in *water*; hence its former name *Soluble Tartar*.—Decomposed by heat, nearly in the same way as the *Acidulous Tartrate* of *Potash*.—Employed only in medicine, as a *mild Cathartic*.

3d. *Tartrate* of *Potash and Soda* (*Soda Tartarizata* P. L.); obtained, by evaporation and crystallization, from the union of *Soda* with *Acidulous Tartrate* of *Potash*.—Form of its crystals, prismatic.—Taste, bitterish saline.—In most of its properties, and in its application, analogous to the *Tartrate* of *Potash*.

Order of attraction of Tartaric Acid, *Lime*, *Barytes*, *Strontian*, *Magnesia*, *Potash*, *Soda*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Alcohol*.

Use confined to *Medicine*.

Of Oxalic Acid.

So called from being contained in the *Oxalis Acetosella,* or *Wood Sorrel.*

Obtained from *Sugar, Malt, Galls,* and various other substances, as well animal as vegetable, by treating them with *Nitric Acid.*

Form, concrete. Crystallizes in transparent quadrangular needles. Taste, very acid.

Readily soluble in *Water:* soluble also, and without decomposition, in the *Sulphuric* and other *Acids, Spirits* of *Wine, Æther, essential* and *expressed Oils.*

Easily decomposed under the application of the higher degrees of *Heat.*

Forms peculiar compounds with the *Alkalies,* with most of the *Earths,* and with several of the *Metallic Oxyds.*

Is more especially remarkable for its affinity with *Lime,* with which it produces an insoluble compound.

Order of attraction, *Lime, Barytes, Strontian, Magnesia, Potash, Soda, Ammonia, Alumine, Metallic Oxyds, Water, Alcohol.*

Used to take out *Iron-moulds,* and as a test for discovering the presence of *Lime.*

Of Citric Acid.

Found abundantly in *Lemons, Limes,* and *Oranges,* also in various other Fruits.—The expressed juice may be concentrated by freezing.—Forms an insoluble salt with *Lime.*—Method of procuring the acid from the compound.—Forms crystals—which are decomposed like other vegetable acids in a strong heat.

Order of attraction, *Lime, Barytes, Strontian, Magnesia, Potash, Soda, Ammonia, Alumine, &c.*

Of Gallic Acid.

Obtained from *Infusion* of *Galls,* by continued exposure to *Air,* edulcoration of the precipitate which takes place, and subsequent Crystallization.

Forms small granular or needle-like crystals, of a sour but not astringent taste.

More soluble in *Spirit* than in *Water.*

Burns in the open fire, leaving behind a hard insoluble charcoal.

[illegible]

[illegible]

Found abundantly in Lemons, Limes, and Oranges; also in various other Fruits.—The expressed juice may be concentrated by keeping [illegible] and [illegible] Method of procuring the acid from the compound. Citric crystals—which are decomposed like other vegetable acids in a strong heat.

[illegible] action on Lime, Baryta, Strontia, Magnesia, Potash, Soda, Ammonia, the [illegible] &c.

[illegible]

[illegible]

[illegible]

Ink. 1 Pt Distilled water - 3 oz Aleppo Galls
1 oz Sulph: Iron - 1 oz of rasped logwood
1 oz of Gum Arabic - a few drops of Oil of Cloves.
Let it stand for a week - should not be kept
in metallic vessels.
To recover old writing that have been obliterated
Take a little prussiate of Potash over the paper
with a Camel's hair pencil - then touch over with
a little dilute sulph. acid - it will appear green
a solution of Nitrate of Cobalt
Take a little of a solution of Acetate of lead and
write on paper the characters will not appear
till Sulph: Hydrogen is passed over it.
To prevent Oxy-muriatic acid from taking out the
Marks - Charcoal should be used in the Ink -
Phosphoric acid produced in the combustion of
Phosphorus - Phosphorous acid may be converted
into it by adding about 1/10 its weight of Nitric
Suspend stick Phosphorus in a current of
and water - small pieces only should be used on
the Nitrous gas papers &c

In close vessels, yields an *acid Liquor*, and a *whitish saline Sublimate.*

A similar salt procurable from Galls, by *simple Distillation*; this also called *Gallic Acid.*

Remarkable for the property of producing a black colour with *Iron* and its saline compounds; hence the formation of *Ink.*

Of Phosphoric Acid.

Sources of this acid various. Usually procured from common *Phosphorus*, by deflagration; or by slow combustion, under long exposure to *Air*; or by treatment with the *Nitric Acid.*

Differs in its sensible properties according to the degree of *Oxygenation*: hence distinguished into *Phosphorous* and *Phosphoric* Acid.—In the latter form, generally liquid; but is capable of assuming a concrete form under certain circumstances. In a platina crucible — [illegible] rapidly [illegible] —

Taste, intensely acid, but not corrosive.—*Specific gravity* 2. 687.

Has a strong attraction for Moisture.

Under the application of the higher degrees of heat, fuses into a transparent *Glass*, capable of re-assuming its *acid properties* by long exposure to *Air* or maceration in *Water*.

With the *Alkalies, Earths*, and *Metals*, forms particular compounds, the chief of which is *Phosphate* of *Soda* (*Soda Phosphorata* P. Ed.); obtained by uniting *Phosphoric Acid* and *Soda* to the point of saturation, evaporating, and cooling. Form crystalline.—Taste not unpleasantly saline—Efflorescent—Dissolves readily in *Water*.—Forms a tripple salt with *Ammonia* (*Sal Microcosmicus*)—Lately introduced as a *cathartic*.

May, like most of the other acids, be partially or totally decomposed, by treatment with different inflammable substances.

In distillation with *Charcoal*, re-produces *Phosphorus*; this therefore considered as its *Radical*.

Order of attraction, *Barytes, Strontian, Lime, Potash, Soda, Ammonia, Magnesia, Alumine, Metallic Oxyds, Water, Alcohol.*

Of Prussic Acid.

Obtained from *Prussiate* of *Iron* (*Prussian Blue*), by boiling this salt in a solution of ppuric Acid found in urine

Benzoic Acid — Sparingly soluble in water
peculiar aromatic smell - obtained from Gum -
Benzoin: - found sometimes in the urine of cows
obtained by boiling the Gum with Lime water
and afterwards treating it with Muriatic Acid

Acid of Amber -

Obtained by boiling Alkali with Animal matter
2d. Acid Bullocks blood
10. Subcarbonate of Potash well mixed put into a crucible. heat applied continuously & kept continued until it comes to a red heat then throw it into water and distil a gaseous ... which is absorbable by water forming the Prussic Acid - very poisonous - peculiar smell. The combinations of this Acid with the Alkalies are soon decomposed by light & heat -
By exposing red oxide of Mercury to Prussiate of Iron - it has a greater affinity & forms a ... soluble salt - Prussiate of Mercury
Its proportions are ascertained by throwing it into the Eudiometer - 16 oz - Hydrogen gen - 2 Oxygen and detonating them -
Alkalies attract it from its combinations with Metallic oxides - whilst Acids will not - solution of Prussiate of Potash poured into a solution of red oxide of Iron. Blue - Prussian Blue -
with Copper - reddish brown -
Lead - white
100 ... Prussiate of Iron - 16,33 - Carbonate of ... 34,05 ... of Prussic acid
Protoxide of Iron 34...
Water 12,...
— 100 -

Potash, adding *Sulphuric Acid* to the liquor when filtered, and submitting it to distillation; or by distilling a mixture of *Prussiate* of *Potash* and diluted *Sulphuric Acid,* and re-distilling the product from *Carbonate* of *Lime.*

According to Gay Lussac may be obtained in a state of perfect purity, by a particular process, from *Prussiate* of *Mercury,* and *Muriatic Acid.*—Exists in the form of a colourless fluid, or in that of vapour.—Contains no *Oxygen.*—Its analysis yields *Carbon, Azote,* and *Hydrogen,* in quantities which afford a striking illustration of the doctrine of definite proportions.

New points of view and nomenclature proposed by Gay Lussac respecting this substance. —*Cyanogen,* or *Prussic Gas,* a new discovered gas, disengaged by heat, from dry Prussiate of Mercury. This gas appears to be the base of Prussic Acid, and yields by analysis *Carbon* and *Azote.*

Form, gaseous.

Unites readily with *Water.*

Combines with *Alkalies, Earths,* and *Metallic Oxyds*; but these compounds easily decomposed by *Carbonic Acid.*

Ferruginous Prussiates—Their uses.—With *Oxyd of Iron, Prussic Acid* re-produces *Prussian Blue.*

Order of attraction, *Barytes, Strontian, Potash, Soda, Lime, Magnesia, Ammonia, Metallic Oxyds, Water, Alcohol.*

OF EARTHS.

Though comparatively few in number, met with under an infinite diversity of appearance, and in such abundance as to constitute the basis of the more solid parts of the globe.

Seldom if ever found free from foreign admixture: when purified artificially, distinguished by their want of *Tenacity, Fixity,* sparing solubility in *Water, Insipidity,* want of *Odour,* incapacity of communicating a tinge to *Glass,* and their specific gravity not exceeding that of *Water* more than in the proportion of five to one.

These characters possessed more perfectly by some of the earths than by others: hence their distinction into *saline* and *insipid.*

All the earths soluble in one or other of the *Acids:* cannot however be precipitated from their solutions, like the *Metals,* by *Prussiate* of *Potash* or of *Lime.*

Infusible even by the most intense degrees of

[illegible] unless a [illegible] [illegible] with each other with Alkali, or other Salts, or with the other Earths.

The Earths at present known are, Barytes, Strontites, Lime, Magnesia, Alumine, Silex, Zircone or Jargon Earth, Glucine, and Yttria.

Of these, Lime, Alumine, Silex, and Magnesia, are by far the most abundant and useful.

Of Metallic, or Ponderous Earths.

Found in combination, [illegible] with [illegible] [illegible] [illegible] of Barytes, [illegible] with Sulphuric Acid; [illegible] [illegible] [illegible] [illegible] with [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] the [illegible] [illegible] [illegible] [illegible]

ept an Baryte pure take powdered Sulph. Bary
uerate it in dilute muriatic acid to get rid of
y Sulph. Lime that may be present.
take equal parts of Sulph. baryte & Mur. Lime
red heat they decompose each other —

lph. barytes	Sulph. Acid		Muriatic acid	Mur. Lim
	Baryte		Lime	

Muriate of Baryte being most soluble may
washed off and evaporated down to crystallize
take some Carb. Potash

b. Potass	Carbonic Acid		Mur. Acid	M. of Ba
	Potash		Baryte	

hen proceed as by Syllabus *

heat, unless in a state of mixture; viz. with *each other*, with *Alkalies*, or *other Salts*, or with *Metallic Oxyds.*

The earths at present known are, *Barytes, Strontian, Lime, Magnesia, Alumina, Silica, Zirconia*, or *Jargon Earth, Glucina*, and *Yttria.*

Of these *Lime, Alumine, Silica*, and *Magnesia*, by far the most abundant and useful.

Of Barytes, or Ponderous Earth.

Found in combination, 1st. with Carbonic Acid, *Carbonate* of *Barytes*; 2d. with Sulphuric Acid (*Sulphate* of *Barytes, Baroselenite*;) or 3d. with Sulphuric Acid, Silex, Sulphate of Alumine, Sulphate of Lime, and Petroleum, (*Liver Stone.*)

Obtained in a caustic or separate state, by exposing a mixture of *Carbonate* of *Barytes* and *Charcoal*, or *Nitrate* of *Barytes*, to a strong heat.

Colour greyish.—Taste caustic, poisonous.

Discovered by Davy to be a *Metallic peroxide.*—*Barium.*—Means of obtaining, and properties.

Slakes like *Lime* on exposure to air, and imbibes water with avidity, forming with it a powerful cement.

Soluble in about 20 times its weight of cold, and in less than twice its weight of boiling water *(Barytic Water,)* from which in cooling it crystallizes in transparent prisms.

Imparts a lemon colour to the flame of *Alcohol.*

Unites with the *Sulphuric Acid* into a compound requiring for its solution 40,000 times its weight of *Water.*

With the *Nitric* and *Muriatic Acids,* forms crystallizable salts.

Unites with *Sulphur* into a species of Hepar *(Sulphuret* of *Barytes.)*

Order of attraction in the moist way, *Sulphuric Acid, Oxalic, Succinic, Fluoric, Phosphoric, Saccho-lactic, Nitric, Muriatic, Citric, Tartaric, Arsenic, Lactic, Benzoic, Acetic, Boracic, Sulphureous, Carbonic,* and *Prussic* ; *Sulphur, Phosphorus Water, Unctuous Oils* ; in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Succinic, Fluoric, Nitric, Muriatic, &c.* ; *Potash, Soda, Sulphur, Oxyd of Lead..*

The *Carbonate of Barytes,* and other forms of this earth, remarkable for their violent effects, when exhibited internally.

The salts of Strontian are distinguished
from those of Barytes by their tinging
the flame of a lamp red.

Used principally as a test for asctertaining the presence of *Sulphuric Acid.*

Of Strontian.

Discovered 1787.

Found either in combination, with carbonic acid; *Strontianite;* or with sulphuric acid, *Sulphate* of *Strontian.*

Best obtained in a separate or pure state from *Carbonate* or *Nitrate* of *Strontian,* by exposing them to a strong heat, as in the preparation of *Barytes,* to which it is analogous in many of its properties.

Discovered by Davy to be a *Metallic Peroxide* —*Strontium.*—*Strontian* nearly resembles *Barytes*—Soluble in 160 parts cold water, in less of hot water—The solution on being evaporated affords crystals of pure *Strontian.*

Remarkable for the brilliancy of the flame which it exhibits when treated on charcoal by the blow-pipe; also for the red colour which it imparts to the flame of *Alcohol.*

The order of its attraction nearly the same with that of *Barytes,* though inferior to it in degree.

Of Lime, or Calcareous Earth.

Found abundantly in different parts of the world, combined with *Carbonic Acid* in the forms of *Chalk, Lime-stone,* and *Marble*—also in the bones and horns of animals, and the shells of fishes and the eggs of birds—Prepared for various purposes from *Carbonate* of *Lime,* by the continued application of a strong heat.

Form contrete or powdery. Taste hot, pungent, caustic.—According to Davy, is a *metallic peroxide.*

Soluble in about 500 times its weight of water (*Liquor Calcis* P.L.) Changes vegetable blue colours to green.

On being suddenly moistened, emits both heat and light, losing at the same time its attraction of cohesion, *Slaked Lime.* The same takes place spontaneously on exposure to *Air.* On further exposure attracts Carbonic Acid from the Atmosphere.

Though infusible *per se,* promotes very powerfully the fusion of most of the other earthy bodies: hence its use in working metallic ores, more especially those of *Iron.*

Melts with *Borax* and *Microcosmic Salt,* with-

[illegible] with Oxide of [illegible]

Use of Lime as [illegible] of [illegible] which gives it the property of [illegible] the action of water—[illegible] of Lime [illegible] of [illegible] Lime-stone.

Sulphate of Lime, called the [illegible] of the arts, soluble in about 500 parts of water, [illegible] of [illegible] water—when heated [illegible] white powder.

Plaster of Paris—its uses.

With Nitric and Muriatic Acids forms salts [illegible]

Phosphate of Lime obtained from burnt bones, constitutes [illegible]

[illegible] Lime found in [illegible] and [illegible] the [illegible]—With [illegible] and [illegible] Acids [illegible] compound, which yields Phosphuretted Hydro[illegible] [illegible]

[illegible] of [illegible] in the [illegible]

Roman Cement – 1/7 pt Lime : combined with fine sand.

Crucibles for [illegible] fitted for cold-clay, [illegible] out effervescence. Melts also with *Oxyd of Lead.*

Use of *Lime* as a cement—composition of mortar—substances which give it the property of resisting the action of water—importance of *Lime* as a manure—methods of analysing *Lime Stones.*

Sulphate of Lime, called also *Gypsum* or *Selenite,* soluble in about 500 parts of water, but in less if the water contain an excess of acid—when heated to redness falls into a soft white powder.

Plaster of *Paris*—its uses.

With *Nitric* and *Muriatic Acids* forms *deliquescent Salts.*

Phosphate of *Lime* obtained from burnt bones: sometimes found native, as in *Apatite.*

Fluate of *Lime* found in Derbyshire, Cornwall, and various parts of the world—When heated *phosphorescent.*—With *Sulphur* forms a calcareous Hepar; with *Phosphorus* a liver-coloured compound, which yields *Phosphuretted Hydrogen Gas* on the affusion of water; with *unctuous substances,* peculiar *Soaps.*

Order of attraction in the moist way, *Oxalic Acid, Sulphuric, Tartaric, Succinic, Phosphoric, Sacco-lactic, Nitric, Muriatic, Fluoric, Arsenic,* *Lactic, Citric, Benzoic, Acetic, Boracic, Sulphureous, Carbonic,* and *Prussic, Sulphur, Phosphorus, Unctuous Oils,* and *Water;* in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Succinic, Nitric, Muriatic, Fluoric, Lactic, Benzoic,* and *Acetic Acid; Potash, Sulphur, Oxyd of Lead.*

Used in *Dyeing, Bleaching, Tanning, Sugar-baking,* and various other arts, besides its application in *Medicine.*

Specimens of Stones in which *Lime* forms a principal part.

Of Magnesia.

Supposed by Davy to be a *Metallic Peroxide.*

Prepared from a solution of *Sulphate* of *Magnesia,* by the addition of *Carbonate* of *Potash,* and subsequent exposure of the washed earthy precipitate to a strong and continued heat (*Magnesia* P. L.)

Form pulverulent. Colour pure white. Taste insipid.

Requires for its solution 7,900 times its weight of water. Tinges vegetable blues of a light green.

Infusible without addition, even in the most intense degrees of heat, by which it is merely

The mode of separating the stones composed
of Lime and Magnesia - dissolve the stone
altogether in Sulph. Acid - then evaporate to
dryness & wash out the Sulph: Magnesia
and the Sulph: of Lime will remain
Oxalate of Ammonia precipitates lime from
any solution of its salts - but the Phosphate
of Ammonia & Soda will precipitate both lime
and Magnesia

contracted in its dimensions: but melts into a glass with *Lime, Microcosmic salt,* or *Borax,* or with a mixture of *alumina* and *silica.*

Unites with all the Acids. With the *Sulphuric Acid,* regenerates *Sulphate of Magnesia (Magnesiæ Sulphas* P. L.) With *Carbonic Acid,* Carbonate of Magnesia *(Magnesiæ Carbonas* P. L.)

May be combined, in small proportions, with *Sulphur.*

Order of attraction in the moist way, *Oxalic Acid, Phosphoric, Sulphuric, Fluoric, Arsenic, Saccho-lactic, Succinic, Nitric, Muriatic, Tartaric, Citric, Lactic, Benzoic, Acetic, Boracic, Sulphurous, Carbonic,* and *Prussic, Sulphur, Phosphorus,* and *Water;* in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Fluoric, Succinic, Nitric, Muriatic, Lactic, Benzoic* and *Acetic Acid; Potash, Sulphur, Oxyd of Lead.*

In common use in disorders of the *Primæ Viæ* as an *antacid* and *laxative,* and in the form of steatite as an ingredient in the Manufacture of the finer kinds of *Pottery.*

Specimens of Stones to which it gives a distinguishing character.

Of Alumina. or Argil.

Obtained in its purest form from a solution of common *Alum*, or *Sulphate* of *Alumina*, by the addition of *Potash*, *Soda*, or *Ammonia;* hence its present denomination.

Form powdery. Colour, when dry, pure white. Feel unctuous. Taste insipid. Smell, when breathed on, earthy.

Insoluble in *Water*. When moistened becomes plastic, and contracts and hardens when exposed to the higher degrees of *Heat;* therefore the basis of the different kinds of *Pottery*. After baking is no longer capable of becoming plastic.

Soluble in the humid way by *Alkalies*.

Fusible, with effervescence, both with *Microcosmic Salt*, and *Borax*, fusible also with *Lime*.

Combines with most *Acids*, though with difficulty, except under precipitation, and produces with them compounds which are more or less astringent. The most important of these, the *Sulphate of Alumina* or *common Alum*, prepared from the decomposition of *Argillaceous Schistus*. This properly a triple, sometimes a quadruple salt. Form of its crystals octohedral. Taste astringent. Soluble in about 14 times its

is distinguished from all the other earths. It does not [illegible]
water to pass thro it after it has been once saturated,
of the most valuable mordants in dyeing, rendering
colours more durable by its attraction for animal & [illegible]
vegetable matter. The Acetate of Argyl is used and
obtained by double decomposition from Acetate of Lead
& Sulph: of Argyl.

Sulphas Argyl. { Argyl / Sulph. Acid } ✕ { Lead / Acetic Acid } Acet: Plumb

French Bole - Bol: Armen: are compounds of Argyl
& Oxides of Iron. and their colors depend on the
different degrees of Oxidation. Fullers earth is used to
take out grease spots - should be dried by the fire - then
moistened and spread on the cloth.

Almost all Clays contain Argyl and some portion [of]
Silex both of these are soluble in caustic potash
& may be separated by dilute Sulph: Acid which
will combine with Argyl and not with Silex. the
Sulph. of Argyl may then be separated by evaporation
& crystallization.

All kinds of earthen ware consist of clay,
[illegible] 40 per cent of [illegible] matter [illegible] and made
of common clay. They are covered with a sheet
glazing. The oxide of lead fuses with an earthy [illegible]
It is mechanically suspended in some water which
is applied over the surface, the water is evaporated
and the oxide fuses with the clay and glazes the surface.
liable to be acted on by vinegar. Stone ware is glazed
by [illegible] of [illegible] which at a very high temperature
fuses with silex. Earthen ware is made by a
clay called pipe clay - pure silicious with alumina
[illegible] in various proportions. They are burned like
their [illegible] matter is destroyed and they are white
they are then thrown into a space like a [illegible]
[illegible]. they are kept in motion by mechanism in water
they are ground down and mechanically [illegible]
in water the coarser particles are allowed to deposit
and the water with the finer is drawn off and [illegible]
by filtration. This is mixed with the pipe clay.
It is passed thro' a [illegible] sieve while moist
and is pumped up like sand into a [illegible] for
[illegible] [illegible] it becomes a tenacious [illegible]
and then worked up well cut out to the size of [illegible]
it is then well kneaded rolled up into balls [illegible]
[illegible] his wheel consists of [illegible] [illegible]
for forming the pots. They are then [illegible] [illegible]
a place to be partially dried.

...ed at least thoroughly dried - then placed
...den and heated up for 40 hours - when it is cold
... in the state of biscuit - when tobacco pipe.
...gures are then delineated - the oxide of metals
... the colors mixed up with oil of ...
... it is to be glazed - the glaze is made with
... lead mixed with oxide of tin made into a glass
... silex and alkali - this is ground very fine and
...chanically suspended in water which is of the
...h like this. the biscuit is dipped in it and exposed
... heat and vitrify's. Porcelain is not so fusible
...es requiring the strongest heat and is a clay
...nd in proper proportions with magnesia. These
... are found to be in China. Porcelain has a
... kind of fracture will strike fire with steel.
...ornish clay has been found a great improvement.

Porcelain is composed of 3 p[ts] silex 2 lime and
magnesia.

Bricks and tiles made of baked clay.
The best are those that do not contain much
lime nor argyl (in great quantities) should be
dry in Autumn. Expose all the contents to the air
subjected to the action of horse-mills. Too large
a quantity of lime oxide make them vitrify.
Their red color owing to oxide of Iron.
Windsor bricks contain silica that renders
them insoluble. Common mortar should not
be used, but Windsor loam moistened with a little
lime. Hessian crucibles are made of equal parts
argyl and silex.

weight of cold, and somewhat more than an equal weight of boiling water. Undergoes watery fusion, and parts with its water of crystallization, on exposure to *Heat* (*Alumen exsiccatum* P. L.) When calcined with certain inflammable substances, as yolk of egg, or sugar, produces a compound, which takes fire spontaneously on exposure to air (*Pyrophorus* of *Homberg.*) Conjecture on the cause of this singular property.

Has, of all the *Earths*, the greatest attraction for *Metallic Oxyds*; has also a strong attraction both for *Silica* and *Magnesia*.

Order of attraction of *Alumina* in the moist way, *Sulphuric Acid, Nitric, Muriatic, Oxalic, Arsenic, Fluoric, Tartaric, Succinic, Saccho-lactic, Citric, Phosphoric, Lactic, Benzoic, Acetic, Boracic, Sulphurous, Carbonic,* and *Prussic*; in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Nitric, Muriatic, Fluoric, Succinic, Lactic Benzoic,* and *Acetic Acid; Potash, Sulphur, Oxyd of Lead.*

Uses, comprehending those of Sulphate of Alumina, *Dyeing, Tanning, Printing, Silvering, Painting, Pottery, Medicine, &c.*

Specimens of Stones containing this Earth in considerable proportion.

Of Silica.

Exists with very little mixture, in Sand, Gravel, Flint, and Rock Crystal.

May be separated from most of these by fusion with either of the fixed alkalies, and redigestion in the nitric or any other of the stronger acids.

Is white. Insipid. Dry to the touch. Sparingly if at all soluble in water. Specific gravity 2.66. Infusible.

Soluble in the *Fluoric,* but in no other acid, unless fresh precipitated, when some of the acids can dissolve minute quantities of it.

Soluble also in solutions of either of the *fixed Alkalies,* by the assistance of heat. Precipitates with lime on being added to lime water; unites too in the humid way with some of the metallic oxyds.

May be fused with *Lime, Microcosmic Salt,* or *Borax;* but much more readily with *Potash* or *Soda:* hence the preparation of the different kinds of *Glass.*

When melted with a large proportion of *Alkali,* forms a deliquescent compound, *(Liquor Silicum,)* the decomposition of which by an silica and alkali fused together will form glass. this was accidentally discovered of old &c. Pliny mentions that it was discovered by a ship laden with soda ashore in the coast of Africa where they used the lumps of soda to support their pots to dress their food in, and it vitrified with the sand. Borax fuses the silica to glass. Lime renders it less liable to crack by changes of temperature. 100 silex 30 of carbonate potash - more durable more than parts of lime. Good glass is made by 12 silex 4 alkali of potash - 4 oz of 2 of oxide of arsenic. Pure glass may be made by silex and alkali alone silex with half its weight of alkali (dissolved)

Crown glass

sand 30 lb 15 purified pearlash - 28 of chalk & small quantity of arsenic

Lead glass contains a large quantity of lead

30 lb sand 35 pearlash - Minium

it makes the best glass

In England are fused in large furnace the [illegible] with its neck broken off made of clay. Fritting is the process of semi-vitrifying the glass preparatory to putting it into the furnace, and a strong heat applied for 36 hours the impurities are skimmed off. Annealing is the gradual cooling of the glass, without which the least force will break them or they will even break spontaneously.

acid forms both a solution and precipitate, thought to be soluble in about 1000 parts of water.

Order of attraction in the moist way, *Boracic Acid, Potash*; in the dry way, *Potash, Boracic Acid, Phosphoric Acid, Oxyd of Lead*.

Used principally in Pottery, Painting, and Glass-making.

Specimens of Stones of which this Earth forms a principal part.

Of Zirconia, or Jargon Earth.

Combined with silex, iron, and nickel in the stone called *Jargon* or *Zircon*; found also in the *Hyacinth*.

Obtained from these by fusion with potash, and subsequent solution in, and precipitation from the *Muriatic Acid*.

Colour, white; insoluble in water; when moist semi-transparent. Specific gravity estimated at 4.300.

When heated in contact with charcoal, is imperfectly vitrified, and becomes of sufficient hardness to strike fire with steel.

Resembles *Silex* in its action on *Alkaline Oxyds*, and *Alumina* in forming astringent com-

Acid furnishes a gelatinous precipitate, thought to be soluble in about 1000 parts of *Water*.

Order of attraction in the moist way, *Fluoric Acid, Potash;* in the dry way, *Potash, Boracic Acid, Phosphoric Acid, Oxyd of Lead.*

Used principally in *Polishing, Painting,* and *Glass-making.*

Specimens of Stones of which this Earth forms a principal part.

Of Zirconia, or *Jargon Earth.*

Combined with silex, iron, and nickel in the stone called *Jargon* or *Zircon:* found also in the *Hyacinth.*

Obtained from these by fusion with potash, and subsequent solution in, and precipitation from the *Muriatic Acid.*

Colour, white. Insoluble in water; when moist, semi-transparent. Specific gravity estimated at 4.300.

When heated in contact with charcoal, is imperfectly vitrified, and becomes of sufficient hardness to strike fire with steel.

Resembles *Silica* in its action on *Metallic Oxyds,* and *Alumina* in forming astringent compounds with the *Acids*: but differs from both in being insoluble in the *Fixed Alkalies*.

Order of its attraction as yet unknown.

Of Glucina.

Obtained by fusing *Aquamarine*, the *Beryl*, or the *Emerald* with three times their weight of *Potash*, separating the *Silica* and *Alumina* by the usual methods—then adding to the solution *liquid Carbonate* of *Ammonia* in excess, and boiling until the *Glucina* precipitates.

Colour, white. Insipid. Insoluble in water. *Adhesive* to the tongue. *Infusible per se*; but melts with *Borax* into a transparent *Glass*.

Soluble in most of the *Acids*, and likewise in the solutions of the fixed *Alkalies* and of *Carbonate of Ammonia*.

Its saline compounds slightly astringent, and of a sweet taste: hence its name.

Its affinity for *Acids* intermediate between that of *Magnesia* and *Alumina*.

Yttria.

Found in the *Gadolinite*, a Swedish stone, so called from this earth being discovered in it by *M. Gadolin*.

Precipitate by [illegible] the [illegible] [illegible] with [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] and precipitating the [illegible] with [illegible].

[illegible]

[illegible]

[illegible] considerably [illegible].

ON [illegible] RESEMBLANCES.

All bodies [illegible] that [illegible] [illegible] [illegible] [illegible] said to be [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

All animals depend on vegetables for their food, and it is the object of Agriculture to get the greatest & best produce from the surface of the earth. The remains of animal and vegetable substances are the proper food of vegetables and they [illegible] in the form of [illegible] or [illegible] the land. Water is especially necessary. Sand having no attraction for it allows it to escape, clay on the contrary absorbs & retains it, and chalk is less [illegible] in it. The greater the moisture the soil absorbs the better it will be.

Procured by treating the powdered mineral with *Nitric* and *Muriatic Acids*—evaporating the solution to dryness—diluting with *Water* and precipitating the *Yttria* with *Ammonia*.

Colour of this earth pure white—Without taste or smell—Iufusible—Spec. grav. 4.84—With *Borax* melts into a white transparent glass—Soluble in *Carbonate* of *Ammonia*, though not in either of the *caustic fixed Alkalies*—Insoluble in *Water*.

With the *Sulphuric*, *Nitric*, *Muriatic*, and with other acids, forms compounds remarkable, like those of *Glucina*, for their astringency and sweetness, to which earth it is considered in many respects as analogous, though in others essentially different.

OF COMBUSTIBLE SUBSTANCES.

All bodies in nature that have not undergone combustion may be said to be susceptible of this change. But the name of *Combustible* is more particularly applied to certain substances which are capable of burning with peculiar energy, when heated to a certain degree in contact with *Air*.

The changes produced on the air in this process, and the alteration which the *Inflammable Substances* themselves undergo, already particularly treated of.

In their form, consistence, weight, volatility, &c. the substances of this class differ widely from each other. They are comparatively lighter than most other bodies.

May be divided into two classes—*Simple* and *Compounded*.

The *simple combustibles* are, *Hydrogen*, *Carbon*, *Sulphur* and *Phosphorus*.

Hydrogen.

Already treated of under *Aeriform fluids*.

Carbon.

Obtained in its common form *Charcoal*, from vegetable, animal and bituminous substances by exposure to heat in close vessels.

Varies in its form, quantity and purity, according to the nature of the substance from which it is prepared.

The charcoal of common wood, black, light, brittle, sonorous, insipid, inodorous, and of great durability.

H. Davy's lamp will not allow flame to
communicated thro the wire gauze with which
surrounded, when ether will not burn.

75,800 lamps — Each equal to 6 wax candles
300000 cubic feet
40 chaldrons of coal used to supply the gas for
lights in London. The smell has been made
objection, but if it is thoroughly burnt there
no smell. Its blackening the ceiling owing to
owing too large flame. Glass tubes should be
— Wood w^d afford inflamable air but it
burns with a blue flame —
of coal become the Hydro-carb: gas is often
placed and sometimes become ignited from
candles used in the mine — Sir H. Davy's
lamp now affords a security — the flame is
closed in a cylinder of gauze wire which
will not admit the gas to be inflamed thro

When the lamp is enclosed in a quantity
of the gas the flame first enlarges and
then goes out – this warns the miner of
the danger & he of course leaves the place
All proportions of Carbur. Hydr. & air
do not detonate
1 of C. at H. G. to 15 of air it burns beyond
this it does not detonate but increases
the flame till it is in the proportion of
30 to 1

Capable of sustaining the most intense degrees of *Heat* in close vessels, without alteration; but upon access of *Air*, burns with a white flame, and yields *Carbonic Acid Gas*, leaving behind a small quantity of *earthy saline Ashes*.

Decomposes the *Sulphuric Acid* and all its compounds, by the assistance of *Heat*.

Decomposes also the *Nitric Acid* without *Heat*, and sometimes with such rapidity as to occasion *Combustion*. Detonates with *Nitre*.

Dissolves, by fusion, in the *fixed Alkalies*; very readily also in *Alkaline Sulphurets*.

Combines by cementation with *Iron* either in a small proportion, *Steel*, or in a larger, *Plumbago*.

Of the properties and uses of native *Plumbago*.

Carbon capable of combining with sulphur, *Oil of Lampadius*, or *Sulphuret of Carbon*.

Charcoal remarkable for correcting *Fœtor* and depriving many substances of *Colour*, especially when used in its fresh burnt state.

Exists in its purest form in the *Diamond*.

Used chiefly as an article for *Fuel* and in certain arts, trades, and manufactures.

Of Sulphur.

Found either uncombined, as deposited by water, or sublimed by subterranean fire, *Native Sulphur*; or in combination with other bodies, more especially with different *Metals*.

May be obtained artificially by the decomposition of *Sulphuric Acid*.

Colour, pale yellow—Sp. Gr. 2.033.—Hard, brittle, insipid, insoluble.--Very easily melted.—Sublimes in close vessels into *light yellow* flowers, formerly called *Flores Sulphuris*.

Burns with a *blue* flame, and by absorbing *Oxygen* from the Air, is converted into *Sulphurous Acid Gas, Sulphurous* or *Sulphuric Acid*, according to the proportion of this principle.—Similar effects are produced on it by deflagration with *Nitre*.

It is little affected by the *Acids*, except by the Nitric.

Unites readily with the *Alkalies*, and also with the *saline Earths*, producing liver-coloured compounds (*Sulphuret* of *Potash*, &c.) which are soluble in *Water*, and may be decomposed by all the *Acids* (*Sulphur Præcipitatum* P. L.)

When intimately mixed with certain propor-

tions of *Potash* and *Nitre*, produces a compound which when gradually exposed to heat, explodes with great violence (*Pulvis fulminans*).

With *Nitre* and *Charcoal*, in mixture, it constitutes common *Gunpowder*.

In the state of vapour combines with carbon at a red heat and in a state of vapour, forming the singular liquid compound, known by the names of *Alcohol of Sulphur, Oil of Lampadius,* or *Sulphuret of Carbon.* Remarkable volatility and other properties of this substance—Results of its analysis.

Sulphur combines by fusion with all the metals except *Platina, Gold,* and *Zinc.*

Is insoluble in *Spirit of Wine,* but unites with *oily* matter of every kind, and with all the liquid *bituminous* bodies, into compounds of increased consistence (*Balsams* of *Sulphur*).

Order of attraction in the moist way, *Lead, Tin, Silver, Quicksilver, Arsenic, Antimony, Iron, Potash, Ammonia, Barytes, Lime, Magnesia, Unctuous Oils, Essential Oils, Æther, Spirit*; in the dry way, *Potash, Soda, Iron, Copper, Tin, Lead, Silver, Cobalt, Nickel, Bismuth, Antimony, Quicksilver, Arsenic.*

Employed principally in *Bleaching*, in the manufacture of *Sulphuric Acid*, and of *Gunpowder*, frequently also in *Medicine*.

Of Phosphorus.

Obtained by decomposing *Phosphate of Lime* (calcined bones) by means of diluted *Sulphuric Acid,* evaporating the supernatent liquor to the consistence of a syrup, mixing it with powdered *Charcoal,* and distilling in the open fire; or by adding *Nitrate* or *Acetite* of *Lead* to common *Urine,* collecting the precipitate, mixing this with *Charcoal* and distilling as above.

Purified by cautious re-distillation, or straining it, when melted, through leather.

Colour, pearly-white.—Semi-transparent.—Waxy.—Insoluble in water.—Very fusible.

When exposed to air, at a low temperature, emits a white fume, and is luminous in the dark; if heated, burns with great rapidity; and in both cases acquires acid properties—*Phosphoric Acid.*

Decomposes the *Nitric Acid,* occasioning combustion by the sudden separation of its *Oxygen,* and evolution of heat.

By treatment with the *fixed Alkalies* or *Lime,* yields a permanently elastic fluid which explodes on admission of air (*Phosphuretted Hydrogen Gas.*)

The method of obtaining Phosphorus —
Calcine bones in an open fire - then treated
with dilute Sulphuric acid - boiling water
added & then strained - the strained
liquor contains Phosphoric acid - then
is heated with charcoal to deprive it of
oxygen and distilled into water —

Dissolves in Alkalies and Oxidizes their Spirit of Wine and Æthers.

Unites by fusion with Sulphur.

Unites also with several of the Metals, and decomposes most of their Salts.

Used in the preparation of liquid [illegible] Phosphoric Matches, and portable Phosphoric Bottles. Attempts have also been made to employ it medicinally in small doses.

Compound Combustibles.

Found abundantly in the vegetable, animal and mineral departments: some prepared artificially.

Consist principally of Hydrogen and Carbon variously combined.

May be divided into five kinds: Alcohol and Æther, Fixed Oils, Volatile or Essential Oils, Resins and Bitumens.

Of Alcohol.

Obtained from saccharine vegetable substances in their progress to [illegible] the Vinous Fermentation, of which [illegible] and [illegible] are [illegible].

Dissolves in *Essential* and *Unctuous Oils, Spirit* of *Wine* and *Æthers*.

Unites by fusion with *Sulphur*.

Unites also with several of the *Metals,* and decomposes most of their *Oxyds*.

Used in the preparation of *liquid Phosphorus, Phosphoric Matches,* and portable *Phosphoric Bottles*. Attempts have also been made to employ it medicinally in small doses.

Compound Combustibles.

Found abundantly in the vegetable, animal, and mineral departments; some prepared artificially.

Consist principally of *Hydrogen* and *Carbon* variously combined.

May be divided into five kinds, *Alcohol* and *Æther, Fixed Oils, Volatile* or *Essential Oils, Resin* and *Bitumen*.

Of Alcohol.

Obtained from such organised substances, or their products, as have undergone the *Vinous Fermentation,* of which those containing *saccharine Matter* are alone susceptible.

This process materially influenced by rest. dilution, temperature, and exposure to air.—Divisible into different stages, the *Saccharine*, which gives rise to Sugar; the *Vinous* productive of Alcohol; the *Acetous* affording Vinegar; and the *Putrid* generating Ammonia.

These changes promoted or retarded by various means, *Ferments*.

Repeated distillation and digestion on dried *Muriate* of *Lime* or on *Potash*, necessary to bring *Alcohol* to its utmost degree of purity.

When pure, colourless and transparent.

Taste hot and pungent. Sp. Gr. 0.815.

Miscible with water in all proportions.

Burns with a bluish flame, producing in combustion *Carbonic Acid Gas* and *Water*.

Dissolves the *Alkalies*, and many of the *neutral Salts*, particularly such as are deliquescent. Also dissolves *Soap*, and acts readily as a solvent on *Essential Oils* and *Resins*, on *Balsams*, and on *Camphor*; hence the preparation of various *Spirituous Liquors*, *Tinctures*, *Varnishes*, &c.

Considered by *Lavoisier* and others, as a compound of *Hydrogen*, *Carbon*, and *Oxygen*, produced by the decomposition of the sugar, in the act of *Fermentation*.—More recent analysis of Alcohol.

[illegible] instrument for measuring sp. Gr.

Sulphuric Ether

Equal weights of acid and alcohol are mixed together — the solution is then placed in a sand bath and distilled at heat of 200° F. [illegible] is to [illegible] of the [illegible] and an oil [illegible] [illegible] of acid [illegible] water into Ether.

Undergoes singular changes in its properties by treatment with the different *Acids*; hence the preparation of *Æthers, Oleum Vini,* &c.

Æthers—Sulphuric, and *Nitric Æther*—Their properties—Mode of preparing them.—De Sausure's recent analysis of *Æther*.

Order of attraction, *Water, Æther, Essential Oils, Ammonia, Potash, Alkaline Sulphurets, Sulphur*.

In general use for various *technical* as well as *dietetical* and *medical purposes.*

Of Fixed Oils.

Obtained both from *Vegetables* and *Animals.*

From the *former* sometimes by boiling, but mostly by pressure, from certain *Fruits, Kernels,* and *Seeds,* hence called *Expressed Oils*; called also *Unctuous Oils*.

From the adipose membrane of the *latter,* of different colours and consistence according to the part, the age, and the species of animal from which it is taken, *Lard, Suet, Fish Oil.*

The difference between Animal and Vegetable Oils not exactly ascertained. The Animal oils in distillation furnish a peculiar acid, *Sebacic Acid*.

Both vary in the temperature at which they become solid; are insoluble both in water and *Alcohol*; become rancid by keeping; yield, by distillation in close vessels, an *acid Phlegm*, a lighter and a denser *Oil*, (*Empyreumatic Oil*,) a large quantity of *Hydrogen Gas* mixed with *Carbonic Acid Gas*, and leave behind a small proportion of *Charcoal*.

Afford *Water* and *Carbonic Acid Gas* by inflammation in contact with air.

By mixture with the stronger *Acids*, produce, in some instances, *saponaceous compounds*; in others occasion *Combustion*.

Unite more perfectly with the *Alkalies*, more especially with *Potash* and *Soda*; with the latter, form common *Soap*.—Nature and properties of this substance.—*Emulsions*.

Unite also into less perfect saponaceous compounds with *Barytes*, *Lime*, and *Magnesia*.

Have no action on any of the *Metals* except *Copper* and *Iron*, but assisted by heat dissolve most of the *metallic Oxyds*, and when separated again from these, are found to be soluble in *Alcohol*.—*Drying Oil*.—*Paints*.

Combine by the assistance of heat, with *Sulphur*, and with most of the *Bituminous Bodies*.

Considered as differing principally from the parts of Oil - contain 79 Carbon - 21 Hydrog[illegible]

[illegible] makes the lead dry - there is Linseed [illegible]

[illegible] being cheaper is generally used - The Oil [illegible]

which is used for Medicinal purposes

[illegible] with the [illegible] [illegible] [illegible]

[illegible] [illegible] - [illegible] [illegible] being [illegible]

its [illegible] colour is [illegible] [illegible]

Drying Oil is [illegible] [illegible] [illegible]

[illegible]

Volatile or Essential Oils, in containing different proportions of Mucilage.

Employed in Painting, Varnishing, Soap-making, in Mechanics, for Fuel, in Diet, Medicine, &c.

Of Sperma-ceti.

Obtained from the brain of a particular species of whale, (*Cetus catodon* Lin.) thence called the *Sperma-ceti whale*; obtained also in small quantity from the oil of the same fish.

After refinement, white, semi-transparent, crystalline, friable, insipid, inodorous.

Differs chiefly from the fixed oils in being little altered by distillation, and not easily acted upon by Acids or Alkalies.

Supposed to have the same relation to Unctuous Oils that Camphor has to the Essential.

Used chiefly for making Sperma-ceti Candles, and in the composition of Ointments, Plasters, &c.

Of Bees Wax.

Deposited by the Bee in the construction of the Honey-comb. Colour, yellow.

Very analogous to Fixed Oils in all its essential properties.

Volatile or Essential Oils, in containing different portions of Mucilage.

Employed in Painting, Varnishing, Soap-making, in Mechanics, for Fuel, in Diet, Medicine, &c.

Of Sperma-ceti.

Obtained from the brain of a particular species of whale, (*Cetus dentatus* Lin.) thence called the *Sperma-ceti whale;* obtained also in small quantity from the oil of the same fish.

After refinement, white, semi-transparent, crystalline, friable, insipid, inodorous.

Differs chiefly from the fixed oils in being little altered by distillation, and not easily acted upon by Acids or Alkalies.

Supposed to have the same relation to Unctuous Oils that Camphor has to the Essential.

Used chiefly for making Sperma-ceti Candles, and in the composition of Ointments, Plasters, &c.

Of Bees-Wax.

Deposited by the Bee in the construction of the Honey-comb. Colour, yellow.

Very analagous to *Fixed Oils* in all its essential properties.

Becomes white on exposure to Air, or treatment with the Oxygenated Muriatic Acid, or Chlorine.

Forms the basis of several Cerates, Ointments, and Plasters.

Employed also in several of the Arts, but principally in making Wax candles.

Of Volatile or *Essential Oils.*

Obtained from most fragrant vegetables, by expression, or distillation with Water.

Taste pungent. Odour, colour, and consistence, various. Most of them lighter, some heavier than water.

Thicken and become less odorous by absorbing Oxygen when exposed to Air; hence the supposed formation of *Balsams* and *Resins*, which differ chiefly in consistence and the occasional presence of *Benzoic Acid.*

Also affected by exposure to Light.

Sparingly soluble in Water; but readily so in Alcohol.

Volatile in close vessels, at or under the temperature of 212 *Farenh.* By repeated distillation lose their characteristic properties, and are brought nearly to resemble each other.

Highly inflammable when heated in contact with Air.

The essential oils are contained in the flowers leaves & bark - never in the seed -

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Highly inflammable when heated in contact with Air.

Decompose the stronger Acids: in some instances with such rapidity as to occasion actual Combustion.

May be united with the Alkalies and Lime so as to form imperfect Soaps.

Combine intimately with Sulphur.

Combine also with Phosphorus, Unctuous Oils, and Camphor.

Purity ascertained by solution in Spirit, or exposure to Heat.

Chiefly employed in Medicine.

Of Camphor.

Thought to be a *Volatile Essential Oil*, containing a large proportion of Carbon.

Exists in many of the fragrant plants, as *Lavender, Rosemary, Marjoram, &c.* but principally procured by distillation with water, from a particular species of laurel, (*Laurus Camphora* Lin.)

Requires certain additions in its subsequent refinement by sublimation.

White. Transparent. Friable. Taste pungent and bitterish. Specifically lighter than water.

Decompose the stronger Acids: in some instances with such rapidity as to occasion actual Combustion.

May be united with the Alkalies and Lime so as to form imperfect Soaps.

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Requires certain additions in its subsequent refinement by sublimation.

White. Transparent. Friable. Taste pungent and bitterish. Specifically lighter than water.

Evaporates completely if kept exposed to the air.

Burns with a white flame, and is entirely consumed.

Sparingly soluble in Water; but readily so in Spirit of Wine and Æthers, in Unctuous and Essential Oils.

Dissolves both in the Sulphuric and Nitric Acid, without decomposition; by repeated distillation with the latter, is converted into a peculiar Acid. Artificial substance resembling Camphor.

Chiefly employed in Medicine.

Of Resinous Bodies.

Resins—Their general properties—Mode of procuring them. *Pitch, Turpentine, Copal,* &c. Their uses—Varnishes.—*Gum-resins*—Their nature—Soluble partly in spirit, and partly in water.—*Balsams*—Their nature and properties.

Of Bituminous Bodies.

Found either liquid and devoid of colour, *Naphtha*; or more or less liquid and of a dark colour, *Petroleum, Barbadoes Tar*; of a harder

Resins are quite soluble in alcohol. Are obtained
either by spontaneous exudation of ligneous
either by the produce of an insect who deposits it on
the bark of trees or application of its young.
Is brought in different states. With alcohol forms
resinaceous compounds. Form varnishes and
called oil or spirit varnish according to the
menstruum in which they are dissolved

Evaporates completely if kept exposed to the air.

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Of Bituminous Bodies.

Found either liquid and devoid of colour, *Naphtha*; or more or less liquid and of a dark colour, *Petroleum, Barbadoes Tar*; of a harder consistence, *Maltha*; or perfectly solid, black, and of a compact or slaty texture, *Asphaltum, Jet, Coal.*

The more liquid Bitumens, by continued exposure to Air, convertible into the more consistent, and all yielding similar products in distillation.

Coal considered as a variety of Bitumen.—Origin, formation, and varieties of Coal.—Artificial formation of Bitumen from vegetable Matter, by heat and pressure. In the different kinds of coal there exists more or less earthy admixture, and often Iron Pyrites.

The bituminous bodies immiscible with Water and insoluble in Spirit of Wine.

Of Amber.

Nearly allied to the foregoing.

Found for the most part in irregular masses more or less transparent, and of a brownish or yellowish colour.—Specific gravity from 1.065 to 1.000. Emits a peculiar odour on friction and becomes electric. Melts at 550° *Fahrenh.* Burns with a whitish flame. In distillation yields Water, Empyreumatic Oil; (*Oleum Succinir P. L.*) and a concrete Acid.

Eau de luce is a solution of amber in Sp
ammon.

consistence, *Maltha*; or perfectly solid, black, and of a compact or slaty texture, *Asphaltum, Jet, Coal.*

The more liquid Bitumens, by continued exposure to Air, convertible into the more consistent, and all yielding similar products in distillation.

Coal considered as a variety of Bitumen.—Origin, formation, and varieties of Coal.—Artificial formation of Bitumen from vegetable Matter, by heat and pressure. In the different kinds of coal there exists more or less earthy admixture, and often Iron Pyrites.

The bituminous bodies immiscible with Water and insoluble in Spirit of Wine.

Of Amber.

Nearly allied to the foregoing.

Found for the most part in irregular masses more or less transparent, and of a brownish or yellowish colour.—Specific gravity from 1.055 to 1.000. Emits a peculiar odour on friction and becomes *electric*. Melts at 550° *Farenh.* Burns with a whitish flame. In distillation yields Water, Empyreumatic Oil; (*Oleum Succinic* P. L.) and a concrete Acid.

Insoluble in Water and nearly so in Spirit of Wine, also in all the acids, the Sulphuric Acid excepted, in the solutions of the Alkalies and in essential and expressed Oils; but the Balsams dissolve it readily.

Of the methods usually employed for rendering Amber transparent.

Is probably of vegetable origin.

OF METALS.

Found generally in the clefts or fissures of stony or other strata, forming what are called *Metallic Veins*; or in indeterminate *Masses*; or in *Beds*; or *disseminated* through other substances.

In these instances they are either *native*; or *alloyed* with each other; or *Oxydated*; or *mineralized* with certain combustible bodies, particularly Sulphur; or lastly, combined with one or other of the Acids.

Different processes therefore commonly necessary for obtaining them in their separate and proper forms; as, *Pounding*, *Washing*, *Roasting*, *Amalgamation*, *Reduction*, and *Refinement*.

When pure, easily distinguished from other

Insoluble in Water and nearly so in Spirit of Wine, also in all the acids, the Sulphuric excepted, in the solutions of the Alkalies and in Ammonia and [illegible]; but the [illegible] dissolves it speedily.

Of the methods usually employed for making Acids, [illegible].

Is probably of vegetable origin.

OF METALS.

Found generally in the clefts or fissures of rocks or other strata, forming what are called Metallic Veins; or in subterraneous Masses; or in Beds; or disseminated through other substances.

In these instances they are either native; or alloyed with each other; or Oxygenated; or mineralized with or united with combustible bodies, particularly Sulphur; or lastly, combined with one or other of the Acids.

Different processes therefore necessarily required for obtaining them in their separate and proper forms; as Pounding, Washing, Roasting, Amalgamation, Reduction, and Refinement.

When pure, easily distinguished from other

A bit of gold leaf weighing gr. 1 may be made
to cover 56 square inches

bodies by their united properties of *Weight, Opacity* and *Splendour,* as well as by their power of conducting the Electric Fluid. *Great specific Weight,* however, is *not* a character common to all Metals.

Some of them remarkable for their *Ductility,* or *Malleability,* or both; others for their comparative *Brittleness*: hence the common though inappropriate distinction into *Metals* and *Semi-metals.*

Differ also from each other in their comparative *Hardness* and *Softness*: when hardened by mechanical extension, may be made soft again by exposure to red heat—*Annealing.*

All fusible in close vessels if heated to their respectively necessary degrees; are convex when in fusion, and in cooling disposed to *crystallize.*

Some, particularly *Iron* and *Platina,* grow soft before they melt, and hence are capable of being united by the operation of *Welding.*

Some, as *Platina, Gold* and *Silver,* remain *fixed* during fusion; others, as *Quicksilver, Arsenic, Zinc* and *Antimony* are *volatile* or convertible into a state of Vapour.

Variously affected on exposure to Air, by which in some instances they are merely tarnished, in others deprived of their metallic properties more completely, being converted into a state of *Oxyd:* hence the utility of Tinning, Silvering, Gilding, &c.

All, (except *Platina, Gold* and *Silver*), still more readily *oxydated* by the united action of *Air* and *Heat*; hence their division by the old chemists into *Noble* and *Base* metals. The circumstances in which these differ from each other in their *Oxydation* are; the comparative facility with which they become oxydated, the temperature required for that purpose, the quantity of Oxygen which they respectively imbibe, the force with which they afterwards retain it, and the phenomena which they present during these processes.

Of *perfect* and *imperfect Metallic Oxyds,* or *Protoxyds* and *Peroxyds.*

Metallic Oxyds, however produced, vary in their properties, not only from each other, but also from their respective metals. Those of the volatile metals much more fixed than the metals themselves: — Some capable of being decomposed or deprived of their Oxygen by heat alone, as those of *Platina, Gold, Silver,* and *Quicksilver* —Such as are not decomposed by the simple application of heat are *vitrifiable;* hence the necessity of *Fluxes.*

[illegible] 1. Bennett - 3 -

Remarkable for the Colours and sometimes for the Opacity which they communicate to Glass: hence the composition of *Pastes* in imitation of precious stones, and also the preparation of *Enamels.*

Metals also capaple of being oxydated by the decomposition of water—Few of them at a common temperature have any considerable action upon water; in general therefore void of taste—some however, when aided by a red heat, readily decompose it, and are thereby converted into Oxyds: hence the explanation of their effects on various other fluids.

Metals also capable of being oxydated by acids—Previous Oxydation necessary to their combination with acids (*Metallic Salts.*) Hence, in their solution, the partial decomposition of the Acid itself, or of the Water by which it is diluted; and the consequent evolution of *Sulphurous, Nitrous* or *Hydrogen* gas.

In some instances they are furnished with so large a proportion of Oxygen as to become insoluble; in others, acidified. (*Acid of Arsenic, of Molybdena,* &c.)

Metallic Salts for the most part possessed of Colour and more or less Corrosive.

Many Metallic Oxyds soluble in solutions of the Alkalies, forming with them permanent compounds. The partial decomposition of the Oxyd by the Alkali sometimes necessary to this.

Neutral Salts, acted on but slowly by Metals unless aided by heat, which, by assisting to decompose their acids, oxydates the metal and renders it combinable with the Alkali.

Metallic Oxyds already formed sometimes combine with Neutral Salts, and produce with them triple compounds.

Iron the only metal capable of *combining with Charcoal;* but this, and almost all the others, or their Oxyds, unite readily with Sulphur, their common mineralizer: many also combine with Phosphorus, and form fusible compounds.

With very few exceptions, they unite with each other by fusion in all proportions.

Metallic Bases of the earths and alkalies.—General history of that discovery.

Classification of metals.—The metals at present known are the following; *Platina, Gold, Silver, Quicksilver, Lead, Copper, Iron, Tin, Bismuth, Nickel, Arsenic, Cobalt, Zinc, Antimony, Manganese, Tungsten, Uranium, Molybdena, Titanium, Tellurium, Chrome, Columbium,*

...ide of Copper in solution - precipitates copper when Ammonia is added - by further addition of Ammonia again dissolved the Ammoniac forming a blue solution

Water decomposes solutions of Oxide Bismuth in Nitric Acid - from its superior attraction for the Acid

Cerium, Platinum, Osmium, Palladium, Rho-
dium.

Of Platinum.

Brought from South America, in small grains of a dull silver colour, and frequently mixed with [illegible], Ferruginous Sand, particles of Native Gold, and in less than [illegible] of several Metallic Bodies. Found also some-times, though rarely, in lumps.—Red and [illegible] [illegible].

[illegible] bodies of [illegible] with [illegible] and Phosphorus, [illegible] silver, and soluble in Nitro-muriatic Acid. Brought also formerly in the large [illegible] particles, mixing with Arsenic and Metals, and [illegible] and [illegible]. Now chiefly obtained by solution of the grains in [illegible] acid, precipitation by [illegible] of ammonia, and consolidation by heat and pres-sure.

Malleable—and [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Copper—[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] state [illegible] in its malleable state [illegible]

has been found is Estremadura in Spain
& some in gold mines of Brazil — but
in very small quantities comes principally
from South America — Rio del Platina —
generally accompanies gold
a little nitro-mur. acid is poured on the ore
to take up the gold which is in about the pro-
portion of 1/1500 — small quantities of Platina
are also dissolved & can be again precipitated
Nitro-muriatic acid is then poured on which
dissolves the whole mass except a little —
the Platina is precipitated by Sal: Ammoniac
in the state of Ammonio: Mur: of Platina. This
it used to be mixed with Arsenic & alloy
which was malleable — the Arsenic was driven
off by heat — but a little remained which
rendered useless. But now the precipitate
heated and put in a mould to which a piston
is fitted and then forming it into a mass.
May be drawn into a wire 1/1000 of an inch
in diameter

Cerium, Palladium, Osmium, Iridium and *Rhodium.*

Of Platina.

Brought from South America, in small grains of a dull silver colour, and commonly mixed with *Quicksilver, Ferruginous Sand,* particles of *Native Gold,* and no less than *four new* discovered *Metallic Bodies.* Found also sometimes, though rarely, in lumps—Bed and matrix unknown.

Various modes of *purification*—Such as fusion with Phosphorus; or amalgamation with Quicksilver, and solution in Oxy-muriatic Acid—Wrought also formerly in the large way by repeatedly melting with Arsenic and Potash, and subsequent roasting and hammering. Now chiefly obtained by solution of the crude ore in oxy-muriatic acid, precipitation by muriate of ammonia, and consolidation by heat and pressure.

Malleability and *Ductility* very considerable. —*Hardness* greater than that of either—*Tenacity* next to Copper—Dr. Wollaston's extremely fine wire—*Specific Gravity,* in its native granular state, 17,7; in its malleable state 21,3; but varying a little according to the degree of compression.

Extremely difficult of *fusion,* unless by a strong voltaic battery, or a current of oxygen gas; but when urged by an intense heat, becomes capable of being *welded,* though not without difficulty.

Less disposed than either Gold or Silver to tarnish on exposure to air—and not Oxydable by it even under the strongest heat; but capable of being reduced to a powdery Oxyd by the Electrical Spark.

Soluble only in the Nitro- and Oxy-muriatic Acids, to which it communicates at first a yellow, and afterwards a deep reddish brown colour.

Precipitable from these solutions by the Alkalies and several of their compounds—With Muriate of Ammonia, it forms a *Triple Salt,* from which the pure Metal may be obtained—Precipitable also by many of the other metals and their solutions, more especially by Tin.

In its metallic state is not acted on, unless exposed to very high temperatures, by Earths or Alkalies, or any of their compound salts, except the Nitrate and Oxy-muriate of Potash, by which it may be superficially oxydated in the dry way.

ammable bodies by heat or moisture

varying a little according to the degree of compression.

Extremely difficult of *fusion*, unless by a strong voltaic battery, or a current of oxygen gas; but when urged by an intense heat, becomes capable of being *welded*, though not without difficulty.

Less disposed than either Gold or Silver to tarnish on exposure to air—and not Oxydable by it even under the strongest heat; but capable of being reduced to a powdery Oxyd by the Electrical Spark.

Soluble only in the Nitrous and Oxy-muriatic Acids, to which it communicates at first a yellow and afterwards a deep reddish brown colour.

Precipitable from these solutions by the Alkalies and several of their compounds.—With Muriate of Ammonia, it forms a Triple Salt, from which the pure Metal may be obtained.—Precipitable also by many of the other metals and their solutions, more especially by Zinc.

In the metallic state is not acted on, unless exposed to very high temperatures, by Earths or Alkalies, or any of their compounds, except the Nitrate and Oxy-muriate of Potash, by which it may be superficially oxydated in the dry way.

Has no affinity with Sulphur; but, like Gold, is soluble in Alkaline Sulphurets—Combines readily with Phosphorus.

When pure, amalgamates intimately with Quicksilver, and unites by fusion, in different proportions, with most of the other *Metals*—most easily with Zinc—With Copper produces a golden-coloured, hard and durable compound, which is malleable, close-grained, and susceptible of a fine polish—remarkable for giving a considerable degree of toughness to Cast Iron: With steel forms a compound incapable of being touched by the file.

Order of attraction, in the moist way, *Æther, Muriatic, Oxy-muriatic, Nitric, Sulphuric, Arsenic, Fluoric, Tartaric, Phosphoric, Sebacic, Oxalic, Citric, Formic, Lactic, Acetic*, and *Succinic Acids*; in the dry way, *Arsenic, Gold, Copper, Tin, Bismuth, Zinc, Antimony, Nickel, Cobalt, Manganese, Iron, Lead, Silver, Quicksilver*—and *Sulphuret of Potash*.

Use, as yet, principally confined to Chemical and Philosophical purposes. Employed to make the touch-holes of guns—likely to be soon more extensively used.

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Use, as yet, principally confined to Chemical and Philosophical purposes. Employed to make the touch-holes of guns—likely to be soon more extensively used.

Of Iridium, Osmium, Rhodium, and Palladium.

These four metals always found mixed or combined with crude platina. *Iridium* and *Osmium,* discovered in the black powder which remains undissolved after the action of nitro-muriatic acid on crude platina; and *Rhodium* and *Palladium* obtained from the solution itself.

Solutions of *Iridium* varying in colour according to the degree of oxygenation of this metal—How obtained pure. Soluble in acids, and especially in the muriatic. From its combination with this acid, may be obtained pure by heat alone.

Osmium, thus called from its peculiar smell.—How obtained. Has never been procured in any other state than that of oxyd.—This oxyd very volatile and soluble in water. From this solution (which is colourless and transparent) the metal can be obtained in the form of a black powder. General properties of this substance.

Rhodium, thus called from the rose colour of its solutions. How separated from crude platina, and obtained in its reguline state. Its general properties.

Palladium, how obtained in its metallic state.

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Palladium, how obtained in its metallic state.

its general properties.—Lately found in Brazil in grains of pure Palladium *mixed* with Platina, but *not alloyed* with it.

Of Gold.

Though less abundant, yet occurs more generally than most of the other Metals.

Found, either alloyed with a small proportion of Silver, Copper, Iron—*Native Gold*; or, combined with Tellurium and Silver—*Black Gold Ore*; or, with Tellurium, Lead, Silver, and Sulphur—*White Gold Ore*—*Aurum Graphicum*.

Manner of collecting it from its ores.

When pure, of a bright yellow colour; soft; inelastic; flexible; very tough; not sonorous; ductile and malleable to an extraordinary degree—Gold leaf—Gilt wire.

Next to Platina the *heaviest* of the metals; its specific gravity when uncompressed being 19.30.

Scarcely tarnishes even by continued exposure to air or moisture.

Melts soon after becoming red hot, or at 32° *Wedgw.*—5237 *Farenht.*—Whilst in fusion, of a sea-green colour.

Gold is separated from its ore by
amalgamation with Quicksilver. The o
first being reduced to powder. The Q. S.
is afterwards driven off by heat.
Frequently it is amalgamated with silver by
from which the gold will be obtained by [illegible]
the amalgam in dilute Nitric Acid — the silv
is dissolved the gold remains which is again
to heat when it becomes perfectly pure and [illegible]
The silver may be obtained from the solution
immersing a plate of copper into it when th
silver will be precipitated.
1 gr. of gold will cover silver wire 260 feet

Its general properties. Lately found in Brazil in grains of pure Palladium *mixed* with Platina, but *not alloyed* with it.

Of Gold.

Though less abundant, yet occurs more generally than most of the other Metals.

Found, either alloyed with a small proportion of Silver, Copper, Iron—*Native Gold*; or, combined with Tellurium and Silver—*Black Gold Ore*; or, with Tellurium, Lead, Silver, and Sulphur—*White Gold Ore—Aurum Graphicum.*

Manner of collecting it from its ores.

When pure, of a bright yellow colour; soft; inelastic; flexible; very tough; not sonorous; ductile and malleable to an extraordinary degree—Gold leaf—Gilt wire.

Next to Platina the *heaviest* of the metals; its specific gravity when uncompressed being 19.30.

Scarcely tarnishes even by continued exposure to air or moisture.

Melts soon after becoming red hot, or at 32° *Wedgw.*—5237 *Farenht.*—Whilst in fusion, of a sea-green colour.

Though unalterable in the common fire, may, by a more intense degree of heat be volatilized, or imperfectly oxydated.

Crystallizes in cooling, into quadrangular pyramids.

If fused by the lowest degree of heat required for that purpose, becomes afterwards brittle—becomes also hard and brittle by compression: hence the necessity of *Annealing*.

In the form of Gold leaf, is converted by electrical explosions into a *purple Oxyd*; and when ignited by the galvanic fluid, burns with a vivid white flame, inclining to blue.

Like Platina, soluble only in the Oxy- and Nitro-muriatic Acids, without effervescence; and in the solutions of Alkaline Sulphurets—Its acid solutions of a yellow colour and caustic, stain the skin purple; and when evaporated, yield deliquescent crystals, which like the oxyds of this metal are decomposed by simple heat.

Gold separable from its solutions by Æthers, Essential Oils, Charcoal, Phosphorus, Hydrogen Gas, and other Combustibles. May likewise be precipitated by all the Alkalies, and Earths in the form of a yellow Oxyd, which by exposure to light is partially decomposed, and becomes of a purple colour, and no longer soluble in acids.

Fulminating gold is the solution of the
tal in Nitro-muriatic acid - precipitated
Ammonia —

Though unalterable in the common fire, may by a more intense degree of heat be volatilised, or imperfectly oxydated.

Crystallizes in cooling into quadrangular pyramids.

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Gold separable from its solutions by Æther, Essential Oils, Charcoal, Phosphorus, Hydrogen Gas, and other Combustibles. May likewise be precipitated by all the Alkalies, and Earths in the form of a yellow Oxyd, which by exposure to light is partially decomposed, and becomes of a purple colour, and no longer soluble in acids.

The precipitate by Ammonia long known for the property of exploding with great violence when exposed to a moderate heat *(Aurum Fulminans.)*—This is an *Ammoniacal Oxyd,* the explosive power of which depends on the double decomposition which takes place between the Oxyd and the Ammonia; hence the effects of exposing Aurum Fulminans to a gentle heat, or of heating it under strong Compression.

The precipitate of Gold by Tin—*(Purple Powder of Cassius,)* proved by the experiments of Pelletier to be an intimate mixture of peroxyd of Tin with protoxyd of Gold.

Gold differing from Platina, in being precipitable from its solution by green Sulphate of Iron; but not by Muriate of Ammonia.

Its Oxyds unite by means of Alkalies with the vitrifiable Earths, forming enamels of a violet-red colour.

Has no affinity in its metallic state for either Sulphur or Carbon; but unites with a small proportion of Phosphorus, and thereby becomes paler, and more fusible.

Combines with all the Metals in various proportions, acquiring different shades of colour and hardness according to the quantity of alloy.

With Copper assumes a deeper colour and

becomes more fusible, harder, and more elastic.—*Coin.*

Amalgamates readily with Quicksilver; hence the art of water-gilding, and the process for collecting Gold from its ores, as before mentioned. Various modes of *Gilding*.

May be freed from admixture of other metallic matter, Silver excepted, by fusion with Lead, or Bismuth under free access of air; hence the process of *Cupellation.*

Most easily and effectually separated from Silver by diluted Nitric Acid: hence the process of *Parting*.

Order of attraction in the moist way, *Æther, Muriatic, Oxy-muriatic, Nitric, Sulphuric, Arsenic, Fluoric, Tartaric, Phosphoric, Sebacic,* and *Prussic Acid, Potash, Ammonia*; in the dry way, *Quicksilver, Copper, Silver, Lead, Bismuth, Tin, Antimony, Iron, Platina, Zinc, Nickel, Arsenic, Cobalt, Manganese, Sulphuret of Potash.*

Used extensively in the construction of Utensils, and different kinds of Ornaments; in Enamelling, Gilding, Dyeing, Soldering, &c.

Water gilding - is done by rubbing a solution of Nitrate of Mercury over the article to be gilded - then apply an amalgam of mercury and gold - then expose to heat and polish

Gold gilding

Dissolve gold in nitro-muriatic acid and soak linen rags in the solution - then burn them and carefully preserve the ashes which will be very black and heavier than common. When anything is to be gilt it must be previously well cleaned, a piece of cork is then to be dipped first in a solution of salt and water and afterwards into the black powder, and the piece after being rubbed with it must be burnished - This is used for delicate silver articles.

Of Silver.

Found, 1*st.* united to a small proportion of Gold, Copper, or Iron, *Native Silver*;—2*d.* in alloy with Antimony; or with Antimony, Arsenic and Iron—*Antimoniated* and *Arsenical Silver Ores*; 3*d.* mineralized by Sulphur—*Vitreous Silver Ore*; 4*th.* combined, in the state of oxyd, with oxyd of Antimony and Sulphur—*Red Silver Ore*; 5*th.* with Lead, Sulphur, Antimony, Iron, Alumine and Silex—*White Silver Ore*; 6*th.* with Muriatic Acid, Oxyd of Iron, Alumine, and a little Sulphuric Acid—*Horn Silver Ore.*

Manner of extracting it from its ores.—Purified by Cupellation or reduction from Muriate of Silver.

Colour white—has neither Smell nor Taste—is less ductile and tenacious than Gold; but harder, more splendid and more opake—Elasticity between Gold and Copper—very sonorous—Secific Gravity from 10,253 to 11,091.

Tarnishes on exposure to air, and becomes occasionally encrusted with Sulphuret of Silver.

Melts below a white heat, or at 28 *Wedgw.* =4717 *Farenh.* Is very brilliant when in fusion

—and in cooling, crystallizes into quadrangular pyramids or octohedrons. By intense heat may, like Gold, be volatilized and partially oxydated.

By electrical explosions is converted into an Oxyd of a greenish grey colour—by the Galvanic Fluid burns with an emerald-green flame.

Its Oxyds decomposable by Heat alone.

Most readily soluble in Nitric Acid—the solution bitter and corrosive—stains the skin and other animal substances black.

Upon evaporation yields a crystallizable salt, susceptible of watery fusion *(Argenti Nitras P.L.)* Yields a Metallic Precipitate to many of the other Metals, as also to Phosphorus, burning Charcoal, burning Sulphur, &c.—and an Oxyd of silver to the Fixed Alkalies and Earths. —With Ammonia forms a triple compound still more remarkable for its fulminating property than that of *Gold (Argentum Fulminans.)* Different modes of preparing this—and causes of failure.

Silver also soluble in Nitro-Sulphuric Acid, *(Aqua Regina of Keir.)*

And in the common Sulphuric Acid, by the assistance of a boiling heat.

Although slightly or not at all acted on by the other Acids, many of these combine readily

All the acids should be diluted to dissolve
silver except pure powerfully.

In the fulminating silver the oxygen of
the oxide unites with the hydrogen of the
ammonia suddenly

Take 40 grs of silver
4 oz of Nitric & cool it
add 2 oz of Alcohol – a white powder
is precipitated which is fulminating
silver.

light passing thro' blue or violet colour
glass has the greatest deoxidizing power

The Amalgam for plating is 2 parts
of the powder precipitated by copper from
silver dissolved in Nitric Acid — 16 parts of
Muriate of Soda and Ammonia — 1/2 the Corrosive
sublimate — made into a paste with a little
water. This is to be rubbed on a plate p-
reviously dipped in a solution of Mercury
in Muriatic Acid — see below.

The best mode of plating is to strew
a little of the powd of Borax on the copper, on
which is then plate of silver is laid and
pressed under rollers.

(Formation) The copper to be plated should be
previously boiled with Tartar and Alum —
and after this with weak [illegible] hot and
[illegible] 4th that 16 Mur Soda
Sulphite. [illegible] 15 or 20 grains Sublimate & the
Another method [illegible] or about 2 drachm
precipitated Oxide of silver — of common salt — 12 drs
of Tartar powdered, 2 drs of
of Alum rub the copper with this composition
till they are perfectly white — then brush off
and polish with leather. Remove the copper
brass previously with Nitric Acid by washing
lightly and then throwing it into water or by
scouring with Salt and Tartar [illegible]

with its Oxyd; hence the decomposition of Nitrate of Silver by Muriatic or Oxy-muriatic Acid, and their compounds, and the consequent formation of Muriate of Silver (*Luna Cornea.*) 19 acid to 81 silver. This remarkable for its easy fusibility, insolubility in water, and becoming dark coloured on exposure to Light, which produces a change of colour, equally striking, in Chromate of Silver.

Silver, in its metallic state, not combinable either with Alkalies or Earths, or with any of their saline compounds.

In the state of Oxyd it communicates yellowish olive or brown colour to Glass.

Unites in various proportions with most of the other Metals, and with all the other combustible bodies, Carbon and Hydrogen excepted.—Loses its ductility by combination with Tin; and with Copper, its usual alloy, becomes harder and more sonorous.—Forms a dark violet coloured mass with Sulphur.—With Phosphorus becomes more fusible and brittle. Different modes used for *Silvering* Copper or other metals.

Order of attraction in the moist way, *Muriatic, Sebacic, Oxalic, Sulphuric, Saccho-lactic, Phosphoric, Nitric, Arsenic, Fluoric, Tartaric, Citric, Formic, Lactic, Acetic, Succinic, Prussic,* and *Carbonic Acids, Ammonia*; in the dry way, *Lead, Copper, Quicksilver, Bismuth, Tin, Gold, Antimony, Iron, Manganese, Zinc, Arsenic, Nickel, Platina, Sulphuret of Potash, Sulphur.*

Used in the construction of various Utensils; in the composition of Bell-metal; in Silvering, Enamelling, Soldering, Medicine, &c.

Of Mercury or *Quicksilver.*

Found chiefly either in a *Native State*; or alloyed with silver, *Native Amalgam*; or in union with muriatic and sulphuric acids, *Horn Mercury*; or mineralized by sulphur, *Native Cinnabar.*

Manner of obtaining it from its ores, and of ascertaining its purity. Freed most effectually from foreign admixture by cautious distillation.

When pure, of a silver white colour, brilliant, fluid at a common temperature, specific gravity 13.568.

Congeals at 39° below 0 *Farenh.* and then found to be malleable.

In its liquid form attracts moisture on exposure to the atmosphere, loses its splendor and contracts a grey pellicle. By agitation with

Mercury may be frozen by a freezing mixture of equal parts Muriate of Lime and Snow, water or by wrapping a tube containing a little mercury with a little cotton dipping it in Sulphuret of Carbon placing it in the exhausted receiver of an Air Pump.

Dr. Marcet thinks the efficacy of Mercu-
preparations depends on their minute di-
vision not on any degree of oxidation —
the vapour [illegible] of the fumes of boiling Mercu-
be inhaled — Salivation is produced.

access of air or trituration with mucilage or other tenaceous substances, is converted into greyish or black impalpable powder—*Æthiops per se.* Hence the more common preparations of quicksilver, viz. *Pilul. Hydrarg.* P. L. *Unguent. Hydrarg.* P.L. *Emplast. Hydrarg.* P.L. &c.

Passes from its liquid state into that of vapour in vacuo even at a common temperature; but under atmospherical pressure, requires to be heated to 600° *Farenh.*

If continued under exposure to air at this temperature, is converted into a sparkling *red Oxyd,* containing a larger proportion of Oxygen than that obtained by trituration, *(Hydrarg. oxyd. rubrum* P. L.)—Chemical properties of this oxyd.—When exposed to a red heat in close vessels it is decomposed, yielding pure Oxygen Gas, and the original Metal.

Per oxyd
oxygen 7
100 Quicksilver
in 100

Quicksilver acts either directly or indirectly on all the Acids.

Partially decomposes and combines with the Sulphuric Acid by the assistance of heat. Produces with it a white ponderous saline mass, which on the affusion of boiling water assumes a lemon yellow colour, *(Hydrarg. Vitriolat.* of the old Pharmac.) The change of colour thought to depend upon the abstraction of a portion of the undecomposed acid.

Dissolves in the Nitric Acid more or less readily, and with a more or less copious evolution of Nitrous Gas, according to the temperature and strength or dilution of the acid—*Nitrate of Mercury.*—This exposed to a low red heat, by a further and more complete decomposition of the acid, yields a red Oxyd, (*Hydrarg. Nitrico-oxyd.* P. L.) Analogous in all its properties to the *precipitate per se,* or common red Oxyd.

Has no action on the common muriatic acid, unless previously oxydated; but with the Oxymuriatic acid combines with great facility and without effervescence: hence the preparation of *Oxy-Muriate of Mercury,* (*Hydrarg. Oxy-Murias.* P. L.) commonly called *Corrosive Sublimate;* and of *mild Muriate of Mercury,* or *Calomel,* (*Hydrarg. sub-Murias.*)

Of the processes employed for obtaining these as well in the moist as in the dry way—new views of these compounds.—Calomel, when washed with lime water, forms the *Oxyd. Hydrarg. cinereum* P. L.

Of the combination of Oxyd of Mercury with the Acetic and other Acids.

The acid solutions of this, like those of other

Muriate of Quicksilver when taken produces inflammation of the mucous membrane of the alimentary Canal - but in small quantities salivation rapidly.

The mode of detecting the presence of ~~Corr~~ Mur: Hydr: - put a piece of gold into a solution of it and bring a bit of Zinc in contact with it the mercury will be separated in a palpable form. - Add a solution of Muriate of Tin to a solution of Mur: Hydr. and it will be detected in the smallest quantity by a copious precipitate

Scheele's Calomel is obtained by mixing a solution of Muriate of Soda with a solution of Mercury in Nitric Acid without heat - this has just the same properties as the common Calomel and is prepared in a much easier way.

Sodae Murias { Muri: acid & Soda } X { Nitric acid, Mercury } Nitr: Hyd:

Scheele's Calomel is obtained by mixing a solu- of Muri: Soda with a solution of Mercury in Nitric acid without heat - this has just the same properties as common Calomel and is prepared in a much easier way.

Sodae Mur { Muriatic acid, Soda } Nitric acid, Mercury { Nitr: Hydr:

Metals, decomposed by Alkalies and Alkaline Sulphurets, and by most of the Earths. The degree of previous Oxydation indicated by the colour of the resulting precipitates; those by Potash and Soda are of a yellow or reddish brown; these by Ammonia of a grey or white colour, (*Hydrarg. Præcipit. Alb.* P. L.) *Ammoniacal Muriate of Mercury.*—FOURCROY.

Zinc, Iron and Copper precípitate Quicksilver from its solutions in its metallic form; a similar effect produced, though slowly, by Phosphorus. —Alcohol, added to the solution of *Nitrate of Mercury* and assisted by heat, furnishes a precipitate, which when dried and heated, explodes with great violence. *Howard's Fulminating Mercury.*

Quicksilver amalgamates with most other Metals; very readily with Gold, Silver, Lead, Tin, Zinc and Bismuth; less easily with Platina, Copper, and Arsenic, and difficultly, if at all, with Iron.

Combines in different modes, and, as was formerly supposed, under different degrees of Oxydation with Sulphur. By fusion and subsequent trituration, or by trituration simply, forms a ponderous black impalpable powder, (*Æthiops Mineral*, or *Hydrarg. cum Sulph.* of the old Pharmac.), in which the Mercury is probably only mixed with the Sulphur, in a state of very minute division; and by fusion and sublimation forms a red striated compound, *(Hydrarg. Sulphuret. Rubr.* P. L.—*Vermillion—Artificial Cinnabar.)*—Which may also be prepared by double decomposition, from a mixture of *Muriate of Mercury* and Sulphuret of Antimony, *Cinnabar Antimonii.*

Preparations analogous to the former procurable, by agitating Quicksilver in solutions of Alkaline Sulphurets.

Order of attraction in the moist way, *Sebacic, Muriatic, Oxalic, Succinic, Arsenic, Phosphoric, Saccho-lactic, Tartaric, Citric, Nitric, Fluoric, Acetic, Boracic,* and *Carbonic Acid;* in the dry way, *Gold, Silver, Platina, Lead, Tin, Zinc, Bismuth, Copper, Antimony, Arsenic, Iron, Alkaline Sulphurets, Sulphur.*

Mercury used in the construction of Philosophical Instruments and Mirrors, in Gilding, in working the Ores of Gold and Silver, making Anatomical Injections, and in Medicine in all the foregoing forms.

Of Lead.

Found 1st. (though very rarely) *Native*; 2*d.* in union with sulphuric acid, *Native Sulphate of Lead*; 3*d.* with acid or oxyd of arsenic, Fulminating Mercury

Take Mercury – 100 grains

and of Nitric Acid – ℥iss. dissolve & add

to the cold solution Alcohol ℥ij – then

apply gradual heat until the precipitate

(white) is formed which must be dried

with a very gentle heat.

Lead is extracted from its ores by fusing
it with

Arsenical Lead Ores; 4*th*. with phosphoric acid, *Native Phosphate of Lead*; 5*th*. with molybdic acid, carbonate of lime and silex, *Molybdate of Lead of Carinthia*; 6*th*. with chromic acid, *Red Lead Ore of Siberia*; 7*th*. with carbonic acid, *Sparry Lead Ore*; 8*th*. with sulphur and a little silver, *Potter's Lead Ore*, or *Galena*; 9*th*. with antimony and a little silver, *Antimonial Lead Ore*.

Manner of extracting it from its Ores.

Colour, blueish white—lustre, considerable—soft—flexible—inelastic—of little tenacity—not sonorous—Spec. Grav. 11.352—more malleable than ductile—does not become harder or of greater Density by compression—Emits a particular smell on friction.

Loses its lustre readily on exposure to Air, becoming first of a dull grey colour, and afterwards whitish.

Melts at 540 *Farenh*. and if cooled slowly crystallizes into quadrangular pyramids. Heated more intensely, it boils and emits fumes; if under exposure to air, it passes readily to the state of Oxyd, and assumes different colours according to the degree of oxydation; hence *Grey Oxyd, Massicot, Litharge, Minium*. These and all the other oxyds of lead easily vitrified, *Glass* *of Lead*; and this easily decomposed, if heated with the addition of Charcoal.

Lead in its metallic state little affected, either by the Sulphuric or Muriatic Acid, but dissolves readily in the diluted Nitric Acid, and forms with it a crystallizable salt.

Exposed, in the form of thin sheets, to the vapour of the Acetic Acid, is converted into a laminated white oxyd (*Flake White, Ceruse*, or *Plumbi Carbonas* of the present Pharm.), which, dissolved in a further portion of this acid, produces a crystallizable astringent salt, remarkable for its sweetness, (*Sugar of Lead, Plumbi Super-acetas*, P. L.) (*Liquor Plumbi Acetatis*, P. L.)

When highly oxydated, as by treatment of its red oxyd by Nitric or Oxy-muriatic Acid, forms a brown precipitate, which inflames without detonation when strongly triturated with Sulphur.

Is precipitated from its solutions, of a white colour, by Alkalies and by Earths; and of a dark brown, by Alkaline Sulphurets and Sulph. Hydrog. Gas. Its solutions also decomposed by the Sulphuric, Muriatic, and Phosphoric Acids, and their compounds.

May be oxydated by deflagration with Nitre; and by fusion with the Fixed Alkalies becomes soluble in water.

Lead is detected in Wine by Sulphuretted Hydrogen, diluting the wine or by Sulph: Hydroge

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Unites by fusion with most of the metals, viz. with Platina, Gold, Silver, Copper, Tin, Bismuth, &c. Amalgamates readily with Quicksilver, but refuses to combine with Iron.

Melts with Sulphur into a grey coloured brittle compound, less fusible than itself, *Artificial Galena*—with Phosphorus, into one which is malleable, but more disposed to tarnish.

The Oxyds of Lead soluble in Expressed Oils and Animal Fats: hence the preparation of certain Plasters, Varnishes and Paints; are capable also of decomposing several of the compounded Salts *(Patent Yellow)*; and remarkably promote the vitrification of earthy bodies and other metallic oxyds, as in Glass-making, and in the Refinement of Gold and Silver.

Order of attraction in the moist way, *Sulphuric, Sebacic, Saccho-lactic, Oxalic, Arsenic, Tartaric, Phosphoric, Muriatic, Nitric, Fluoric, Citric, Formic, Lactic, Acetic, Boracic, Prussic* and *Carbonic Acid, Potash*; in the dry way, *Gold, Silver, Copper, Quicksilver, Bismuth, Tin, Antimony, Platina, Arsenic, Zinc, Nickel, Iron, Alkaline Sulphurets, Sulphur.*

Employed in Medicine, and very extensively in the Arts, particularly in the construction of Buildings, and different Utensils; in the making of Shot, in Statuary, Glass-making, Glazing, Painting, Varnishing, Refinement of Gold and Silver, Composition of Pewter, and Plumber's Solder, &c. &c.

Of Copper.

Found 1*st*. *Native*; 2*d*. combined with oxygen and sometimes with iron, *Tile Ore, Pitch Copper Ore*; 3*d*. with carbonic acid, *Green* and *Azure Copper Ore*; 4*th*. with arsenic acid, *Arseniate of Copper*; 5*th*. with sulphuric acid, *Sulphate of Copper*; 6*th*. with muriatic acid, *Muriate* of *Copper*; 7*th*. with sulphur, *Vitreous Copper Ore*; 8*th*. with sulphur and iron, *Yellow Copper Ore*; 9*th*. with arsenic and iron, *White Copper Ore*; and 10*th*. with lead, antimony, iron, sulphur, alumine, silex and silver, *Grey Copper Ore*.

Manner of extracting it from its ores, and of purifying it.

Colour, bright brownish red—taste, nauseous styptic—odour, when rubbed disagreeable—hardness, somewhat greater than that of Gold or Silver—Malleability, Ductility, and Tenacity considerable—Sp. Gr. if soft, 7.788, if com-

the Effects of Lead on Animal Economy
very formidable bringing on constipation
spasms, — causing Colica Pictonum called
also Pictonum — seldom inflammatory
Purgatives are indicated — but previously
Opium should be given to relax the
Spasm — [illegible] — [illegible].

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

The Sulphate of Copper is [illegible] emetic and [illegible]

It may be given in cases where immediate [illegible] is

required - in cases of poisoning from opium.

The [illegible] Sulphate of Copper [illegible] spread

pretty thickly over lint and moistened with

water - then thickly wrapped [illegible] and then

[illegible] of [illegible] light [illegible] place - the [illegible]

[illegible] to the extent of [illegible]

The Alkalies precipitate the Copper in a state of ox[illegible]

from all the solutions of its salts, and are [illegible]

[illegible] redissolve them again

pressed, nearly 9—When hard, elastic and sonorous.

On exposure to Air loses its lustre and contracts a greenish rust: in the open Fire is converted into a dull brownish red or black Oxyd, which heated to redness with filings of Copper, assumes an orange colour.

Fuses at 27° *Wedw.* =4587 *Farenh.* and if heated more intensely is volatilized in fumes.—In cooling slowly crystallizes into quadrilateral pyramids.

Is more or less acted on by all the Acids.

Dissolves with the assistance of a boiling heat in concentrated Sulphuric Acid, and affords transparent oblong rhomboidal crystals of a deep blue colour, *Sulphate of Copper, Blue* or *Roman Vitriol (Cupri Sulphas* P. L.)—Triturated with Carbonate of Ammonia forms the *Cuprum Ammoniatum* of the L.P.

Dissolves in diluted Nitric Acid with effervescence and the production of Nitrous Gas, forming a deep blue solution, and by evaporation a deliquescent salt, which detonates on being suddenly heated *(Nitrate of Copper.)* The precipitate obtained from this solution by adding Chalk, forms a beautiful but fugitive pigment, *Blue-verditer.*

Is in its metallic state slowly acted on by the Muriatic Acid, unless assisted by heat; the solution, of a grass green colour, on evaporation yields cubical crystals, whilst a solution of the orange coloured oxyd before mentioned, yields colourless octohedrons, which are not affected by Ammonia, unless after exposure to air.

Moistened with the Acetic Acid, under exposure to air, corrodes into a green saline oxyd, *Verdegris of Commerce (Ærugo* P. L.), which by additional acid dissolves, and yields a beautiful dark green transparent soluble salt, *Distilled Verdegris:* both employed as pigments.

Easily attacked by the Sebacic Acid of rancid oil or fat, especially if before in any degree oxydated.

Most of the saline preparations of Copper, particularly the Nitrate and Muriate, soluble in Alcohol, which then burns with a green flame.

Is more or less acted on by all the Alkalies. With Ammonia forms a beautiful blue solution, which disappears on the exclusion, and returns on the admission of Air.—Ammonia the most delicate test of the presence of Copper, with the exception mentioned above.

Is precipitated of a fine grass green colour from its solution in Sulphuric Acid, by Arsenite

...bxides of Copper are very soluble in Ammon...
...sulphate of Potash poured into a solution of
...ate of Copper produces a green precipitate
...led Mineral green - Paper red - The sulphide
...s the same

Bot. [illegible] 1
Blyborough
[illegible] 2

Verdigris is composed a very
...e which burns on the fire at first with
...variety of colour but at last with a beautiful
...e color

Standard gold is an alloy of 11 Copper in 12 of g[illegible]
Standard Silver — D° in 12 of Sil[illegible]
Bell Metal Copper and Tin. — Brass Copper & Zin[illegible]

of Potash, *Scheele's Green Pigment.* Of a blue colour from the Nitric Acid by Chalk, as before mentioned; and in a metallic state from all its solutions, by Zinc and Iron, *(Zement Copper.)*

Detonates with melted Nitre, and by the assistance of heat decomposes Muriate of Ammonia.

Unites by fusion with many of the other Metals, forming very important compounds. With Platina forms one of great density and hardness; with Gold, *Standard Gold;* with Silver, *Standard Silver* and *Silver Solder;* with Tin, *Bronze* and *Bell-metal;* with Arsenic, *Tombac;* with Zinc, *Brass* and *Manheim Gold;* and with Antimony, a violet coloured alloy.

Combines also with Sulphur and Phosphorus by fusion. Is tarnished by immersion in hepatized Water.

The Oxyds of Copper, impart a greenish colour to Glass; and a black tinge when mixed with Manganese and Iron.

Order of attraction in the moist way, *Oxalic, Tartaric, Muriatic, Sulphuric, Saccho-lactic, Nitric, Sebacic, Arsenic, Phosphoric, Succinic, Fluoric, Citric, Formic, Lactic, Acetic, Boracic, Prussic* and *Carbonic Acids, Potash, Soda, Am-*

monia, Unctuous Oils; in the dry way, *Gold, Silver, Arsenic, Iron, Manganese, Zinc, Antimony, Platina, Tin, Lead, Nickel, Bismuth, Cobalt, Quicksilver, Alkaline Sulphurets, Sulphur, Phosphorus.*

Uses very extensive, being employed in the construction of Buildings and Coppering of Ships; in the formation of various Culinary or other Utensils, in Bell and Cannon Founding, in Coinage, in Enamelling, Dyeing, Painting, and Medicine.

Of Iron.

Of all metals the most frequently and abundantly met with, and generally in the following forms; 1*st*. *Native.*—Circumstances always attending the presence of *Native Iron*—Native Iron proved to be of *Meteoric Origin.*—Description and chemical history of *Meteoric Stones.*—Origin of these stones discussed; 2*nd*. in state of grey oxyd, *Grey Iron Ore*; 3*d*. in state of red oxide, *Hæmatite*; 4*th*. united with carbonic acid, *Spathose Iron Ore*; with carbonic acid, alumine, and often phosphoric acid, *Argillaceous Iron Ore*; 5*th*. with sulphuric acid, *Native Sulphate of Iron*; 6*th*. with chromic acid, alumine,

W. Mc.omey When visiting the Brazils heard of a
[illegible] of metal at some distance - on coming to which
found it to be a huge mass of native iron. 14,000 lb -
Olea fers offered the proposition of these Aeroliths
being propelled from some other planet - Chl[illegible]
[illegible] that a body propelled with 3 times the velocity
cannon ball would in a short time be thrown beyond
sphere of the Moon's attraction. Other philosophers
[illegible] that they may be formed by the decomposition of
fluids in the air, raised from our earth - but the
present ideas of chemical knowledge cannot at [illegible]
[illegible] such a formation.
Iron [illegible] 90. percent Iron - attracted by the magnet
[illegible] - [illegible] - Elba Iron beautifully [illegible]
[illegible] - wrought Iron 7,7

The Meteoric stones contained native Iron
alloyed with Nickel a substance not found
on the surface of this globe. This seems to show
that they fell from some other planet.
The idea was at first laughed at by the French
Institute but whilst they were debating on it
a number of these stones fell at Aigle in Normandy
which on examination afforded the same results

Iron in the first degree of oxidation is magnetic Iron, in which that species is contained – and a magnet is formed by arming it with iron. – The others are more highly oxidated Iron – mix'd with various substances. To obtain it from its ores – the ores must be roasted, to expell the Sulphur – then it is put into a furnace with charcoal & kept hard some time – the charcoal deoxidizes the iron – the lime unites with the Sulphur – the ore runs out at the bottom of the furnace and then is called – pig iron – this contains a portion of Carbon – rendering it less malleable and more fusible – very brittle & very hard. To purify this it is melted and forged – melted with charcoal to take away its carbon when it becomes like a thick paste – then it is subjected to hammers – and is worked into bars called bar iron – or forged Iron & Pig. Steel may be procured by melting cast Iron with Charcoal, but mostly by merely heating it with Charcoal – the former is called Cast Steel. This renders it brittle & is unused in weight and silex, *Native Chromate of Iron*; 8*th*. with sulphur, *Iron Pyrites*; with arsenic, *Mispickel*, *Arsenical Pyrites*.

As obtained from its ores by the usual process of reduction, forms a fusible mass, of a blueish grey colour and coarse granular fracture, very hard and brittle. *Crude* or *Cast Iron*, which freed from its impurities by continued exposure to a strong heat and subsequent hammering and rolling, loses its brittleness, becomes of a lamellar or fibrous texture, and capable, when red hot, of having several portions welded by compression into a continuous mass, *Bar* or *forged Iron*.

This, by cementation or fusion with charcoal, acquires weight, becomes again fusible, brittle when cold, of a close granular texture, susceptible of a high polish, very elastic and capable of taking on a great degree of hardness if heated and suddenly cooled, *Common* and *Cast Steel*. Operation of *Tempering*.

Bar Iron the purest. Colour of this blueish grey, when polished very splendid—has a slightly subacid taste, and when rubbed a sensible odour—harder than most other metals—more tenacious than any—considerably more ductile than malleable; Sp. Gr. from 7.600 to 8.166.

Iron distinguished by its being attracted by the Magnet.

Susceptible of different degrees of Oxydation. *Black* and *Red Oxyd.* Is speedily converted into a yellowish or reddish brown rust on exposure to air and moisture, (*Rubigo Ferri* of the former Pharm.); and still more speedily into a dark grey oxyd, by combustion in Oxygen Gas, digestion in warm Water, or the application of its vapour to it under ignition.

Dissolves more or less readily in all the Acids. Its solution generally accompanied with the evolution of Hydrogen Gas, and the resulting compounds possessing different properties according to its degree of Oxydation.

Requires the aid of heat to decompose Concentrated Sulphuric Acid, but dissolves readily in it when diluted, and yields a pale green crystallizable salt, *Sulphate of Iron, Martial Vitriol* (*Ferri Sulphas* P. L.). A less pure salt obtained by the decomposition of Iron Pyrites, *Copperas of Commerce.* With the Red Oxyd, Sulphuric Acid forms *Red Sulphate of Iron.*

Rapidly decomposes the Nitric Acid, by which, unless in a diluted state, it is rather oxydated than dissolved.

The Red Oxyd dissolves readily in the Mu-

temper steel and make it very hard
& brittle it must be suddenly cooled
plunging it into cold water. To harden
edge of a tool, it is heated to redness
& then dipped in water it is then heated
in – and from the different colors they
give of the degree of hardness they want &
when it is at that degree plunge it into
water. Iron very ductile a wire
.. inch diameter will support 250 lbs

Black oxide of Iron is obtained by burning
iron wire in oxygen gas.

Indian Ink has carbonaceous matter for its basis — no iron —

riatic Acid, and produces a yellowish brown solution, miscible with spirits of wine (*Tinctura Ferri Muriatis* P. L.).

Soluble by digestion in the Acetic Acid, hence the chalybeate properties communicated by it to the different kinds of wine, (*Vinum Ferri* P. L.).

Unites also easily with Acid of Tartar (*Ferrum Tartarisatum* P. L.).

With Prussic Acid forms *Prussian Blue*. Prussiate of Potash or of Lime therefore employed as tests for ascertaining its presence.

In combination with Carbonic, as well as Sulphuric, or Muriatic Acid, becomes soluble in water; hence the properties of *Chalybeate Springs*.

With Gallic Acid produces a black precipitate, the basis of common *Ink*.

Precipitates spontaneously in the form of ochre from most of its acid solutions on exposure to Air. When thrown down from these by a carbonated Alkali, may be re-dissolved by the addition of a further portion of it, (*Liq. Ferri alkalini* P. L.).

Combines with the Fixed Alkalies by fusion.

Deflagrates with Nitrate of Potash; and sublimes with Muriate of Ammonia, which it partially decomposes *(Ferrum Ammoniatum* P.L.).

When in the state of Oxyd, promotes the fusion of several of the Earths, and communicates different tinges to Glass, according to the degree of oxydation.

Unites by fusion with all the other metals, except Quicksilver, Lead, and Bismuth. In combination with Arsenic, becomes brittle when heated, *(Red-short Iron.)*

Has of all metals the strongest attraction for Sulphur, with which, when heated, it unites very readily into a dark grey, brittle, and remarkably hard compound, *Artificial Pyrites.*

Is also capable of entering into combination with phosphorus, *(Cold-short Iron)*, and with charcoal, *Steel* and *Plumbago.*

Order of attraction in the moist way, *Oxalic Acid, Tartaric, Sulphuric, Saccho-lactic, Muriatic, Nitric, Sebacic, Phosphoric, Arsenic, Fluoric, Succinic, Citric, Formic, Lactic, Acetic, Boracic, Prussic,* and *Carbonic;* in the dry way, *Nickel, Cobalt, Manganese, Arsenic, Copper, Gold, Silver, Tin, Antimony, Platina, Bismuth, Lead, Quicksilver, Alkaline Sulphurets, Sulphur, Phosphorus.*

Uses too extensive to be enumerated.

In plumbago the carbon is in the proportion of 90 to 10. In steel there is only 1/140. Rot glu[?]
[?]ed — To make pencils smoother —

15,000,000 lb. of Iron actually extracted from the earth annually in Europe.

tially decomposes (Ferrum ammoniatum P.L.)

When in the state of Oxyd promotes the fusion of several of the Earths, and communicates different shades to Glass, according to the degree of oxydation.

Unites by fusion with all the other metals, except Quick-silver, Lead, and Bismuth. In combination with Arsenic, becomes brittle when heated, (Red-short Iron.)

Has of all metals the strongest attraction for Sulphur, with which, when heated, it unites very readily into a dark grey, brittle, and remarkably hard compound, *Sulphuret of Iron.*

Is also capable of entering into combination with phosphorus (Cold-short Iron) and with charcoal, Steel and Plumbago.

Order of attraction in the moist way, *Oxalic Acid, Tartaric, Sulphuric, Saccho-lactic, Muriatic, Nitric, Sebacic, Phosphoric, Arsenic, Fluoric, Succinic, Citric, Formic, Lactic, Acetic, Boracic, Prussic, and Carbonic.* In the dry way, *Nickel, Cobalt, Manganese, Arsenic, Copper, Gold, Silver, Tin, Antimony, Platina, Bismuth, Lead, Quicksilver. Alkalies, Sulphuret, Sulphur, Phosphorus.*

Uses too extensive to be enumerated.

Of Tin.

Found rather united with Oxygen than Sulphur—Spathose Tin Ore; or with Sulphur, Copper, and Iron—Tin Pyrites.

Colour silvery white; splendid; the lightest of all the ductile metals, (its Sp. Gr. when pure being only from 7.291 to 7.300,) and next to Lead the softest; malleable; comparatively of little Tenacity or Ductility; but considerably extensible; has a strong disagreeable taste, and emits a peculiar Odour when rubbed.

Tarnishes under exposure to air; but scarcely oxydated even by the combined action of air and moisture; hence its use as a covering to Iron and Copper.

Melts long before ignition, (442° Fahrenheit,) and kept in Fusion with access of Air is rapidly converted into a Grey Oxyd.—Being a mixture of Oxyd of Tin and [illegible]—By a continuance of the heat or a higher [illegible] White Oxyd, commonly [illegible] Putty [illegible] White [illegible] Oxyd obtained by [illegible], which is changed to the [illegible] of Water.

Probably when nearly or just oxygenated, [illegible]

Of Tin.

Found either united with Oxygen and Iron—*Spathose Tin Ore*; or with Sulphur, Copper and Iron—*Tin Pyrites*.

Colour silvery white; splendid; the lightest of all the ductile metals, its Sp. Gr. when pure being only from 7.291 to 7.600; and next to Lead the softest; inelastic; comparatively of little Tenacity or Ductility, but considerably malleable; has a strong disagreeable taste, and emits a peculiar Odour when rubbed.

Tarnishes under exposure to air, but does not speedily oxydate even by the continued action of air and moisture; hence its use as a covering to Iron and Copper.

Melts long before ignition (440° Fahr.); if kept in Fusion with Access of Air, it soon is converted into a Gray Oxyd.—Putty, a compound of Oxyd of Tin and Oxyd of Lead.—By strong Ignition of the same is changed into a yellowish White Oxyd, extremely difficult of fusion or reduction (Flowers of White Oxide); a similar Oxyd obtained by exposing tin, when in a state, to the vapour of Water.

Breaks when nearly or just congealed, ...

Of Tin.

Found either united with Oxygen and Iron—*Spathose Tin Ore;* or with Sulphur, Copper, and Iron—*Tin Pyrites.*

Colour silvery white; splendid; the lightest of all the ductile metals, (its Sp. Gr. when pure being only from 7.291 to 7.500,) and next to Lead the softest; inelastic; comparatively of little Tenacity or Ductility, but considerably malleable; has a strong disagreeable taste, and emits a peculiar Odour when rubbed.

Tarnishes under exposure to air; but does not speedily oxydate even by the combined action of air and moisture; hence its use as a covering to Iron and Copper.

Melts long before ignition (410° *Farenh.*), and kept in Fusion with access of Air is easily converted into a *Grey Oxyd.—Putty,* a compound of *Oxyd of Tin* and *Oxyd of Lead.* By a continuance of the heat is changed into a perfectly *White Oxyd,* extremely difficult of fusion or reduction (*Basis of White Enamel*); a similar Oxyd obtained by exposing tin, when in fusion, to the vapour of Water.

Broken when nearly or just congealed, exhibits an irregular columnar Structure, and by agitation while passing from the fluid to the solid state, may be reduced into very small grains *(Pulvis Stanni* P. L.)

Does not dissolve in the Sulphuric Acid, but by the assistance of heat decomposes it and becomes oxydated.

Rapidly decomposes the Nitric Acid, with a copious evolution of Nitrous Gas, and is converted into a white Oxyd; but in the considerably diluted acid, unaided by heat, dissolves and forms Nitrate of Tin, which burns with a thick white flame, and detonates in a heated crucible.

Dissolves readily in the Muriatic Acid; the solution yielding needle-form crystals which attract moisture.

Dissolves with still greater readiness in the Oxy-muriatic Acid, and in the Nitro muriatic Acid, or Aqua Regia, yielding solutions remarkable for their property of forming a brilliant and permanent scarlet precipitate with infusion of Cochineal and other analagous substances, *(Carmine,* and *Scarlet-dye).* When united with Oxy-muriatic Acid in the dry way, (by distillation with Muriate of Mercury,) a volatile colourless liquor is obtained, which, on ex-

he Aurum Mussivum is a combination of
ulphur with Tin - used in bronzing. formerly in
edicine.

While Tin is dissolving in muriatic acid - Hydro
gas is evolved -

opper vessels are tinned over by laying a
ayer of Tin over it being previously dipped in grease
th alloy with copper it forms the composition for
aking reflecting telescopes -

An amalgam of tin is used to coat
mirrors with

posure to the air, emits copious dense white fumes, *Smoking Liquor of* Libavius.

Is slowly corroded by the continual application of the Acetic Acid in the form of vapour; and by long digestion, this acid dissolves a small proportion of it.

The solutions of Caustic Fixed Alkalies, assisted by heat, exert a solvent power both on Tin and its Oxyds, but most on the latter: Caustic Ammonia affects only the Oxyds.

Is little affected in the dry way, either by Alkalies or Earths. Detonates rapidly with Nitre, and decomposes Muriate of Ammonia.

Decomposes moistened Nitrate of Copper with such a degree of rapidity and violence as to produce actual combustion.

May be united more or less readily with all the other Metals, and in various proportions; occasioning in most of them an alteration in their Malleability, Fusibility, Specific Gravity and Hardness: with Copper, according to the proportions, forms *Gun-Metal, Bronze, Bell-Metal, Speculum-Metal*; with a small proportion of Iron becomes harder and more sonorous; with half its weight of Bismuth forms *Tutenag*; with an equal weight of Lead, *Soft Solder*.

When free from Arsenic, does not, in small quantity, much impair the malleability of Gold.

Melted with Sulphur, produces a dark grey, striated, brittle compound; which, if prepared by sublimation, is of a light spongy texture and composed of golden coloured scales, used to imitate bronze, *Sulphuretted Oxyd of Tin, Aurum Musivum;* which may also be prepared by heating gradually equal parts of Sulphur and the White Oxyd.

May also be combined with Phosphorus.

Order of attraction in the moist way, *Sebacic, Tartaric, Muriatic, Sulphuric, Oxalic, Arsenic, Phosphoric, Nitric, Succinic, Fluoric, Saccholactic, Citric, Formic, Lactic, Acetic, Boracic, Prussic Acids, Potash, Ammonia;* in the dry way, *Zinc, Quicksilver, Copper, Antimony, Gold, Silver, Lead, Iron, Manganese, Nickel, Arsenic, Platina, Bismuth, Cobalt, Alkaline Sulphurets, Sulphur, Phosphorus.*

Employed in the composition of Solder, Pewter, Bell and Gun-metal, Printer's Types, &c. in the silvering of Mirrors, construction of Electrical Instruments; in Tinning, Enamelling, Dyeing, Medicine, &c.

When free from Arsenic, does not, in small quantity, much impair the malleability of Gold.

Melted with Sulphur, produces a dark grey, striated, brittle compound; which, if prepared by sublimation, is of a light spongy texture and composed of golden coloured scales, used to bronze bronze, *Sulphuretted Oxyd of Tin, Aurum Mosaicum*, which may also be prepared by heating gradually equal parts of Sulphur and the White Oxyd.

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Order of attraction in the moist way, *Sebacic, Tartaric, Muriatic, Sulphuric, Oxalic, Arsenic, Phosphoric, Nitric, Succinic, Fluoric, Saccholactic, Citric, Formic, Lactic, Acetic, Boracic, Prussic Acids, Potash, Ammonia*; in the dry way, *Zinc, Quicksilver, Copper, Antimony, Gold, Silver, Lead, Iron, Manganese, Nickel, Arsenic, Platina, Bismuth, Cobalt, Alkaline Sulphurets, Sulphur, Phosphorus.*

Employed in the composition of Solder, Pewter, Bell and Gun-metal, Printer's Types, &c. in the silvering of Mirrors, construction of Electrical Instruments; in Tinning, Enamelling, Dyeing, Medicine, &c.

Of Bismuth.

Found 1st. *Native*; 2d. in union with Oxygen, *Native Oxyd*; 3d. with *Sulphur*: *Sulphuret of Bismuth.*

Manner of procuring it from Ores.

Colour, yellowish white.—Specific gravity 9.822.—Texture foliated—not very brittle.

But little subject to tarnish. *Melts at* 460° *Fahrenh.* and in cooling crystallizes into cubes.

If kept in fusion with access of Air, is converted at first into a bluish, and afterwards into a brown Oxyd.—Heated to redness, burns with a small blue flame, and emits a yellowish smoke, condensible into an Oxyd of a similar colour, (*Flowers of Bismuth*,) which by increase of heat, melts into a greenish Glass, analogous to Glass of Lead.

Dissolves most readily in the Nitric Acid, and furnishes a salt, which detonates readily when exposed to sudden Heat; and which may be decomposed by the affusion of Water, yielding a white Oxyd (*Magistery of Bismuth*). The other acids dissolve its Oxyds, but do not act upon the metal.

Its precipitate by Sulphuret of Ammonia is of a similar appearance to that which this test produces from solutions of Lead.

Deflagrates both with Nitre and with Oxymuriate of Potash, and is converted into an Oxyd, which, like those already mentioned, facilitates the fusion of the Earthy Bodies, and also of the other Metallic Oxyds.

Combines with most of the other metallic Substances, rendering Platina, Gold, and Silver more brittle, and the metals in general more fusible.

Precipitates Platina, Gold, Silver, and Quicksilver from their acid solutions, but is itself precipitated by Lead.

Has very little affinity to Phosphorus.

Unites easily with Sulphur into a blueish-grey striated compound, which resembles the native Sulphuret, and may be decomposed by Silver and Lead.

Its Oxyds, like those of Lead, dissolve in Unctuous Oils by the assistance of heat.

Order of attraction in the moist way, *Oxalic Acid, Arsenic, Tartaric, Phosphoric, Sulphuric, Sebacic, Muriatic, Nitric, Fluoric, Saccho-lactic, Succinic, Citric, Formic, Lactic, Acetic, Prussic, Carbonic, Ammonia;* in the dry way, *Lead, Silver, Gold, Quicksilver, Antimony, Tin, Copper, Platina, Nickel, Iron, Zinc, Alkaline Sulphurets, Sulphur.*

Deflagrates both with Nitre and with Oxy-muriate of Potash, and is converted into an Oxyd, which, like those already mentioned, facilitates the fusion of the Earthy Bodies, and [illegible] the other Metallic Oxyds.

Combines with most of the other metallic Substances, rendering Platina, Gold, and Silver very brittle, and the Metals in general more fusible.

Precipitates Bismuth, Gold, Silver, and Quicksilver from their acid solutions, but is itself precipitated by Lead.

[illegible] very little if any to Phosphorus.

[illegible] readily with Sulphur into a [illegible] compound, which resembles the native [illegible], and may be decomposed by [illegible] and [illegible].

[illegible] the Salts of Lead, [illegible] in [illegible] the [illegible] of [illegible].

Order of affinities of [illegible] the same way [illegible]

[illegible]

Used in the composition of Pewter, Solder, and Printer's Types, in Painting, Imitation of Silvering, and occasionally in place of Lead in the refinement of Gold and Silver, and in Assaying. The white Oxyd of Bismuth, usefully employed as a medicine.

Of Nickel.

Found 1*st.* alloyed with Iron, *Native Nickel*; 2*d.* combined with Oxygen, *Native Oxyd*; 3*d.* with Iron, Arsenic, Cobalt and Copper, *Kupfer Nickel.*

Extremely difficult to obtain it free from iron: accordingly varies somewhat in colour, being occasionally reddish, yellowish or greyish white.—Specific gravity also varies from 7.88 to 9.333.—Texture minutely granulated. Hard, yet somewhat malleable. Is likewise magnetic.

Requires nearly the same heat as iron to fuse it; is very fixed in the fire, and difficult of oxydation by heat.

Deflagrated with Nitre yields a greenish Oxyd, which communicates a hyacinthine tinge to Glass.

All its solutions of a green colour: that in the Nitric Acid (in which it dissolves most readily) affords green rhombic crystals. Precipitated from its solutions by lime water and by the alkalies; Ammonia re-dissolves it, and produces a blue solution.

Forms brittle compounds with Gold, Copper, Iron and Tin.—All the Meteoric Stones contain Nickel united with Iron; refuses to combine either with Silver or Quicksilver, and unites readily by fusion both with Sulphur and Phosphorus.

Order of attraction in the moist way, *Oxalic, Muriatic, Sulphuric, Tartaric, Nitric, Sebacic, Phosphoric, Fluoric, Saccho-lactic, Succinic, Citric, Formic, Lactic, Acetic, Arsenic, Boracic, Prussic, and Carbonic Acids, Ammonia;* in the dry way, *Iron, Cobalt, Arsenic, Copper, Gold, Tin, Antimony, Platina, Bismuth, Lead, Silver, Zinc, Alkaline Sulphurets, Sulphur, Phosphorus.*

This Metal not yet applied to any use.

Of Arsenic.

Found 1*st.* alloyed by Iron, *Native Arsenic*; 2*d.* combined with Oxygen, *Native Oxyd*; 3*d.* with different proportions of Sulphur, *Realgar,*

Orpiment; and *4th.* with Sulphur, Iron, and sometimes Silver, *Mispickel.*

Colour, steel-grey—texture, scaly, granular, —very brittle, but not hard.—Specific gravity 8.31.—Much disposed to tarnish.

Volatile in close vessels at 356° of *Farenh.* and in condensing crystallizes in tetrahedrons.

If exposed to Air under the heat of ignition, burns with a blue flame, and is converted into a white Oxyd, *Common white Arsenic, Flowers of Arsenic, Arsenious Acid.*

This said to be soluble in about 80 times its weight of cold, and 15 times its weight of boiling water. Taste caustic.—Less volatile than the Regulus.—Emits a garlic smell on the application of Heat.—Vitrescible.—Promotes the fusion of Earthy Bodies. When melted with Sulphur, produces different shades of colour, according to the proportions and the degree of Heat or state of oxydation; hence artificial *Orpiment* and *Realgar.*—By treatment with the Nitric Acid, becomes more completely oxygenated, *Arsenic Acid.*—Decomposes Nitre in the dry way, producing a neutral crystallizable salt, *Arsenical Salt of Macquer.*—If distilled with unctuous matter, reassumes the form of Regulus.

In its metallic state, decomposes most of the mineral acids; the nitric most readily: if powdered and thrown into Oxy-muriatic Acid Gas, burns with a white flame.

Unites with most of the other Metals; rendering brittle those which are ductile, and in a remarkable manner increasing the fusibility of some, and diminishing that of others: thrown into Oxy-muriatic Acid Gas, burns with a blue flame.

To the red and yellowish metals communicates a silvery whiteness.

Soluble in Alkaline Sulphurets. Soluble also in Unctuous Oils, with which it forms a consistent mixture.

Combines readily with Phosphorus.

Most of the preparations of this metal in a high degree noxious; the detection of their presence therefore often of great moment. Various *Tests of Arsenic*, viz. Nitrate of Silver and Ammonia—Sulphate of Copper and Potash—and above all, Reduction by carbonaceous matter.—Water impregnated with sulphuretted hydrogen, and solutions of Alkaline Sulphurets, recommended as *antidotes*. Emetics, purgatives, and copious dilution, the most effectual of these.

Order of attraction in the moist way, *Muriatic Acid, Oxalic, Sulphuric, Nitric, Sebacic,*

After having taken Arsenic the symptoms
are sickness nausea burning thirst - severe
[illegible] pains - painful [illegible] - faintness
cramps - convulsions and death.
After death the stomach is found inflamed
[illegible], even the Anus is sometimes eroded
tho there be no continuity of inflammation
the inflammation is confined to the internal
[illegible] of the stomach - unless [illegible] very severe
[illegible].
Emetics should be given first - Castor oil
[illegible] - [illegible] to proceed in Chemistry
[illegible] water [illegible] - hepar Sulphuris has been
given to convert it into Orpiment
The tests of its presence are.
The fluid in the stomach especially if [illegible]
[illegible] pulp - add a little warm water to it
and filter it. this will do to operate on
The first reagent would be Ammo. Nitrate of Silver
[illegible] - add a drop of Ammonia first
then a drop of the solution of Nitrate of Silver - a
[illegible] yellow sediment is formed. this test
is very delicate, will detect [illegible]

a little phosphate of Soda dissolved in the
produce the same appearances, with the same
tests: but if we examine the precipitates we
can soon detect the difference - if we place
that formed from Ph. Soda in a tube & apply
& become deep-
heat this will dry & emit a little moisture - but
that formed from Arsenic becomes volatile emits
garlic smell and adheres to the sides of the
tube in the form of white oxide

To detect the arsenic of the Arseniate of Silver formed
by the above precipitation - mix it with a little
mixture of dried Alkali and charcoal - put it
in the bottom of a tube apply heat - and the arsenic
will be sublimed in its metallic form.

Another test is produced by adding a drop of
Ammonia to the suspected liquor, then a little
sulphate of Copper - and a green precipitate will
be formed which is Scheele's Green - a similar
precipitate though might be formed by ammoniacal
[illegible] therefore liable to error

...ut 100 years ago Arsenic was recom-
...ended as a cure for intermittent fever
... tasteless ague drops, as they were called, and we
...re discovered by Dr Fowler to be Arsenic
...and by him principally introduced into
...ractice under the name of Solutio Mineral-
...is Liq: Arsen: 4 drops of which contain
[illegible] of a grain. When an over dose is given
...ausea - vomiting - straining - fluttering
...adach - and a rash resembling Urticaria
...is given from 1 to 12 Drops.

Tartaric, Phosphoric, Fluoric, Saccho-lactic, Succinic, Citric, Formic, Lactic, Arsenic, Acetic, and *Prussic, Ammonia, Unctuous Oils, Water*; in the dry way, *Nickel, Cobalt, Copper, Iron, Silver, Tin, Lead, Gold, Platina, Zinc, Antimony, Alkaline Sulphurets, Sulphur, Phosphorus.*

Used principally in Glass-making, Painting, and Medicine. (*Arsenici Oxydum præparatum; Liquor Arsenicalis,* P.P.)

Of Cobalt.

Found 1*st.* alloyed with Arsenic, *Grey Cobalt Ore*; 2*d.* united to Oxygen, *Native Oxyd*; 3*d.* to Arsenic Acid, *Cobalt Bloom*; 4*th.* to Sulphur, *Sulphuret of Cobalt*; and 5*th.* to Arsenic, Iron, and Sulphur, *White Cobalt Ore.*

Colour, light grey. Specific gravity, from 7.7 to 8.53.—Compact, brittle; hardness that of Tin; magnetic.

When very pure, malleable in a red heat.—Fuses at 130 *Wedgw.* and in cooling crystallizes in regular prisms.—Undergoes no change either on exposure to Air or Water at a common temperature; but, when heated in contact with air, yields at first a brownish oxyd, *Zaffre,* which on further exposure becomes blue, and on fusion with Silex, produces a blue glass, *Smalt, Powder-blue.*

Dissolves with more or less facility in several acids; most easily in the Nitric Acid.

With the Muriatic and Oxy-muriatic Acids forms compounds, the reddish solutions of which, as often as exposed to heat, or well dried by any other means, change to a beautiful green, *Sympathetic Ink.*

Detonates feebly with Nitre.

Unites by fusion with most of the other Metals.

Combines difficultly if at all with Sulphur; more readily with Alkaline Sulphurets.

With Phosphorus forms a compound more fusible than itself.

Its Oxyd soluble in Ammonia.

Order of attraction in the moist way, *Oxalic Acid, Muriatic, Sulphuric, Tartaric, Nitric, Sebacic, Phosphoric, Fluoric, Saccho-lactic, Succinic, Citric, Formic, Lactic, Acetic, Arsenic, Boracic, Prussic, Carbonic, Ammonia;* in the dry way, *Iron, Nickel, Arsenic, Copper, Gold, Platina, Tin, Antimony, Zinc, Alkaline Sulphurets, Sulphur? Phosphorus.*

Used to colour Glass, in Glazing, Enamelling, Painting, Washing, &c.

which on farther exposure becomes blue; as ; on its combination with Silex, fused into a blue glass, Smalt, [illegible].

Fusible, with more or less facility in several modes; [illegible].

With the Sulphuric and the Muriatic Acids forms compounds, the reddish solutions of which, when [illegible] exposed to heat, or well dried by any other means, change to a beautiful green. Sympathetic Ink, &c.

Detonates partly with Nitre.

United by fusion with most of the other Metals.

Combines difficultly if at all with Sulphur; more readily with Alkaline Sulphurets.

With Phosphorus forms a compound more fusible than Cobalt.

Its Oxyd soluble in Ammonia.

Ores [illegible]

[illegible] Cobalt [illegible] Ore, [illegible] ore, in the dry way, [illegible] Cobalt Ochre, [illegible]

[illegible] Cobalt, [illegible], &c.

Of Zinc.

Found 1st. combined with Oxygen, and frequently mixed with Oxyd of Iron, Silex and Alumine. *Calamine*; 2d. with Sulphur, *Sulphuret of Zinc, or Blende*; 3d. with Sulphuric Acid, *Sulphate of Zinc*; 4th. with Carbonic Acid, *Carbonate of Zinc*.

Colour bluish white. Specific Gravity 7.190.

Scarcely malleable, but can be rendered so by a particular process of annealing.

When heated is easily pulverised; and like iron is capable of decomposing water. Melts at about 700° of Fahrenh. Very easily sublimed.

In contact with air, burns soon after ignition, with a brilliant flame, and furnishes a white flocculent Oxyd (*Zinci Oxydum*, P. L.) convertible by an increase of heat into a yellowish glass.

Is readily acted on by Acids. During its solution in the Sulphuric and Muriatic Acids, Hydrogen Gas is evolved. Produces with the former Acid, a styptic crystallizable salt, (*Zinci Sulphas* P. L.): is also acted on by Alkaline solutions and by Water previously impregnated with Carbonic Acid Gas.

Of Zinc.

Found 1*st.* combined with Oxygen, and frequently mixed with Oxyd of Iron, Silex and Alumine, *Calamine;* 2*d.* with Sulphur, *Sulphuret of Zinc*, or *Blende;* 3*d.* with Sulphuric Acid, *Sulphate of Zinc;* 4*th.* with Carbonic Acid, *Carbonate of Zinc.*

Colour blueish white. Specific Gravity 7.190.

Scarcely malleable, but can be rendered so by a particular process of annealing.

When heated is easily pulverised; and like iron is capable of decomposing water. Melts at about 700° of *Farenh.* Very easily volatilized.

In contact with air, burns soon after ignition, with a brilliant flame, and furnishes a white flocculent Oxyd (*Zinci Oxydum*, P. L.) convertible by an increase of heat into a yellowish glass.

Is readily acted on by Acids. During its solution in the Sulphuric and Muriatic Acids, Hydrogen Gas is evolved. Produces with the former Acid, a styptic crystallizable salt, (*Zinci Sulphas* P.L.); is also acted on by Alkaline solutions, and by Water previously impregnated with Carbonic Acid Gas.

May be precipitated from its solutions by Earths and Alkalies.

Decomposes, in the dry way, Sulphate of Potash and many other compounded salts. Detonates violently with Nitre. By simple trituration decomposes Muriate of Ammonia. Is also capable of precipitating Alum in the moist way.

Unites with all the other metallic substances except Bismuth; giving to Copper additional elasticity, durability and hardness.—Brass.

In its metallic form cannot be combined with Sulphur; but when oxydated unites readily with it.

Order of attraction in the moist way, *Oxalic, Sulphuric, Muriatic, Saccho-lactic, Nitric, Sebacic, Tartaric, Phosphoric, Citric, Succinic, Fluoric, Arsenic, Formic, Lactic, Acetic, Boracic, Prussic, and Carbonic Acids, Ammonia*; in the dry way, *Copper, Antimony, Tin, Quicksilver, Silver, Gold, Cobalt, Arsenic, Platina, Bismuth, Lead, Nickel, Iron.*

Uses—in Alloys, particularly with Copper and Tin; externally and internally in Medicine. —A powerful agent in evolving Galvanism.

May be precipitated from its solutions by Lime and Alkalies.

Decomposes, in the dry way, Sulphate of Potash and earthy compounded salts. Decomposes [illegible] with Nitre. Its simple [illegible] compounds Muriate of Ammonia. Is also capable of precipitating Alum in the moist way.

Unites with all the other metallic substances except Bismuth, giving rise [illegible] chiefly to ductile and [illegible].

In general it [illegible] cannot be combined with [illegible] but which [illegible] more readily [illegible].

Order of attraction in the moist way. Oxalic, Sulphuric, [illegible] Muriatic, Nitric, Sebacic, Tartaric, Phosphoric, Citric, Succinic, Fluoric, [illegible] Lactic, Acetic, Boracic, Prussic, and Carbonic Acids; in the dry way, Copper, Antimony, Tin, Quicksilver, Silver, Gold, Cobalt, Arsenic, Platina, Bismuth, Lead, Nickel, Iron.

Uses—in Alloys, particularly with Copper and Tin; externally and internally in Medicine —A powerful agent in exciting Galvanism.

May be precipitated from its solution by Earths and Alkalies.

Decomposes, in the dry way, Sulphate of Potash and many other compound salts. It [illegible] with Water. By simple [illegible] [illegible] Sulphur or Ammonia. Is also capable of precipitating Alumina in the moist way.

Unites with all the other metallic substances except [illegible], giving to Copper additional [illegible], [illegible] and hardness.—Bergm.

It [illegible] cannot be combined with [illegible] [illegible] readily [illegible].

[illegible] of [illegible] in the [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] Copper [illegible]. The [illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] with [illegible] [illegible] [illegible] [illegible].

Of Antimony.

Found 1*st*. *Native*; 2*d*. alloyed with Arsenic, *Native Arsenical Antimony*; 3*d*. in union with Oxygen, *Native Oxyd*; 4*th*. with Muriatic Acid, *Muriate of Antimony*; 5*th*. with Arsenic Acid and Sulphur, *Red Antimonial Ore*; 6*th*. with Sulphur only, *Grey Antimonial Ore*; and 7*th*. with Iron, Arsenic, Sulphur, and sometimes Silver, *Plumose Antimonial Ore*.

Manner of extracting it from its ores, and the different processes for obtaining its *Regulus*.

Colour, silvery-white. Hardness, equal to Zinc. Texture, laminated. Very brittle. Sp. Gr. from 6.702 to 6.860. Simply loses its lustre on exposure to the Air; and is not altered by Water unless exposed to it when red hot.

Melts soon after ignition; on cooling crystallizes into octohedrons; is *volatile* in close vessels. When heated in contact with Air is converted into a light white Oxyd, (formerly called *Argentine Flowers of Antimony*) which is soluble in water, and fusible into an *hyacinthine* glass; in close vessels, by parting with different portions of oxygen, this oxyd acquires a brown, orange, or yellow colour.

Decomposes both the Sulphuric and Nitric Acids, the former with, the latter without, the assistance of heat. Requires long digestion for its solutions in the Muriatic Acid; but in the Oxy-muriatic dissolves with great facility.

Precipitable from the latter by Zinc or Iron, in the form of a black Oxyd, which when dried by a gentle heat takes fire spontaneously in the air, and is converted into white Oxyd.

Decomposes, in the dry way, most of the saline Compounds of the Sulphuric Acid. Detonates readily with Nitre; and decomposes Muriate of Mercury.

Combines with most other Metals, and renders them brittle. Said more than any other metal to diminish the Magnetic property of Iron.

Unites with Sulphur in all proportions, and forms with it a grey striated compound, *Crude Antimony* of the shops, artificial *Sulphuret of Antimony*.

This, when exposed for a continuance to a low heat, yields a *Grey Oxyd*, which by fusion is converted into a yellowish Glass (*Vitrum Antimonii* of the former Pharmac.;) this levigated and mixed with melted wax, forms the *Vitrum Antimonii Ceratum* of the late P.E.

Roasted with Hartshorn and afterwards igni-

Decomposes with the Sulphuric and Nitric Acids, the former with, the latter without, the assistance of heat. Requires long digestion for its solution in the Muriatic Acid; but in the Nitro-muriatic dissolves with great facility.

Precipitable from the latter by Zinc or Iron, in the form of a black Oxyd, which when dried by a gentle heat takes fire spontaneously in the air, and is converted into white Oxyd.

Decomposes, in the dry way, most of the saline Compounds of the Sulphuric Acid. Detonates readily with Nitre; and decomposes Muriate of Mercury.

Combines with most other Metals, and renders them brittle. Said more than any other metal to diminish the Magnetic property of Iron.

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This, when exposed for a continuance to a low heat, yields a Grey Oxyd, which by fusion is converted into a yellowish Glass: (Vitrum Antimonii of the former Pharmacopœias.) This levigated and mixed with melted wax is the Cerated Antimony (Cerated Glass of the late Pharmacopœia.)

Roasted with Hartshorn and afterwards igni-

...vomiting when taken into the stomach ...

...ses emetic and sudorific properties – the

...er oxides are almost inert – protoxides ...

...owerful – Vomit & Diaphor: ...

Oxyphos...

...ides – Peroxides – Antim: Calcin: & ...

...ce prepared – Emetic: Calcis – ...

Powder of Algaroth: formed by precipitat^d ...

Muriate of Antimony with water –

Ph: Chem: Lond: Protoxide – Hydr. Sulph: ...

...Antim: Tart: Sulph: Antim: Praep: – Pulvis Antim...

ted, yields a white Powder *(Pulvis Antimonialis* of the P. L.—*Oxydum Antimonii cum Phosphate calcis* P. E.)—When deflagrated with Nitre, is more or less decomposed according to the degree of combustion *(Antimonium Calcinatum—Antimonium Ustum cum Nitro—Crocus Antimonii* of the former P. L. and P. E.

Reduced to powder and boiled in a solution of Potash, deposits, on cooling, an orange coloured precipitate (*Kermes Mineralis* Ph. Suec.); and on the addition of the Sulphuric Acid to the solution whilst hot, a brownish red precipitate, *(Antimonii Sulphuretum præcipitatum* P. L.) These are *Hydro-sulphurated Oxyds of Antimony*.

A mixture of Sulphuret of Antimony and Muriate of Mercury, or of Crocus (Protoxyd) of Antimony and common Salt, with the addition of Sulphuric Acid, produces, by distillation, a butyraceous compound, *(Antimonium Muriatum* of the late P.L.), which appears to be an *Oxy-muriate of Antimony,* and which on the affusion of common water, or by the addition of Potash, furnishes a *white Oxyd,* or rather *Sub-oxy-muriate, (Powder of Algaroth.)* The combination of this with acidulous Tartrite of Potash (Crystals of Tartar), forms a triple salt *(Antimonium Tartarisatum* of the old P.E.).

A similar preparation obtained from the combination of the Crocus, or Glass, or any of the other protoxyds of Antimony with crystals of Tartar. (*Antimonium Tartarisatum*, L.P.), a compound which, like the former, is soluble in water and in different kinds of Wine (*Antimonii tartarisati liquor* P.L.).

The preparations retained in the present Pharm. of London are *Antimonii Oxydum, Antimonii Sulphuretum præcipitatum, Antimonium tartarisatum, Liquor Antimonii tartarisati.*—Nature of these preparations.

Order of attraction in the moist way, *Sebacic Acid, Muriatic, Oxalic, Sulphuric, Nitric, Tartaric, Saccho-lactic, Phosphoric, Citric, Succinic, Fluoric, Arsenic, Formic, Lactic, Acetic, Boracic, Prussic* and *Carbonic*; in the dry way, *Iron, Copper, Tin, Lead, Nickel, Silver, Bismuth, Zinc, Gold, Platina, Quicksilver, Arsenic, Cobalt, Alkaline Sulphurets, Sulphur*.

Used in the composition of Printer's Types, and of Nails for Coppering Ships, in Medicine, &c.

Of Manganese.

Found 1*st*. *Native*; 2*d*. in union with Oxygen, *Native Oxyd*; and 3*d*. with Oxygen, Silex,

In the new London Pharmacopoeia the Sulph.
and Antim: Tart: are made at the same
time. Not very clear – but Sulph: Acid
dissolves the Oxide – Nitric Acid hydrogen
the Crocus only – when it is in a condition
to unite with Tartaric Acid – Their hydrate
are formed we may be sure our operation
correct

A similar compound is obtained from the combination of the Oxyds of Copper, or [illegible] or any of the other [illegible] with crystals of [illegible] [illegible] [illegible] a compound which, like the [illegible] [illegible] water and in different kinds of [illegible] [illegible] [illegible]).

The [illegible] contained in the present [illegible] of [illegible] [illegible] Oxygen, [illegible] Sulphur [illegible] [illegible] [illegible] [illegible] [illegible] Nitrogen of [illegible].

Tables of [illegible] in the same way. Sulphuric Acid, Muriatic, [illegible] Sulphurous, Nitric, Tartaric, Saccho-lactic, Phosphoric, [illegible] [illegible] [illegible] [illegible] [illegible] Lactic, Acetic, Boracic, Fluoric and Carbonic; [illegible] [illegible] Iron, Copper, Tin, Lead, Nickel, Silver, Bismuth, Zinc, Gold, Platina, Quicksilver, Arsenic, Cobalt, Alkalies, Sulphurets, Sulphur.

Used in the composition of Printer's Types, and of Nails for Coppering Ships, in Medicine, &c.

Of Manganese.

Found in Nature, &c. in union with Oxygen, [illegible] Oxyd, and [illegible] Oxygen [illegible].

Iron, and Silex. [illegible] also to be contained in the ashes of some Vegetables.

Colour dull or greyish white. Fracture granular. Sp. Gr. from [illegible]. [illegible] to Iron. Very brittle.

Is exceedingly difficult to fuse; but crystallizes more easily than any other metal. Its Oxyds of different colours, viz. green and brown.

Soluble in the diluted Sulphuric, in the Nitric, Muriatic, and several other acids.

In the state of Oxyd, occasions in the Muriatic Acid a striking change of properties, by imparting to it a portion of its Oxygen.

New mode of forming the Oxymuriatic Chorine.

Its action on the Alkalies not yet ascertained.

When oxydated, decomposes both Nitrate of Potash and Muriate of Ammonia, in the dry way.

In this state unites by fusion with the earthy bodies, and when added to glass, either renders it colourless, or communicates a violet tinge, according to the degree of oxydation.

Unites also, by fusion, with Sulphur, into a yellowish-green mass. By mixture with earthy substances, sometimes occasions vitrification.

Iron, and Alumine, *Siliceous Manganese.*—Said also to be contained in the ashes of most Vegetables.

Colour dull or greyish white. Texture granular. Sp. Gr. from 6.850 to 7. Hardness next to Iron. Very brittle.

Is exceedingly difficult to fuse; but oxydates more easily than any other metal: its Oxyds of different colours, white, red and black.

Soluble in the diluted Sulphuric, in the Nitric, Muriatic, and several other acids.

In the state of Oxyd, occasions in the Muriatic Acid a striking change of properties, by imparting to it a portion of its Oxygen.

New mode of viewing this combination. *Chlorine.*

Its action on the Alkalies not yet ascertained.

When oxydated, decomposes both Nitrate of Potash and Muriate of Ammonia, in the dry way.

In this state unites by fusion with the earthy bodies, and when added to glass, either renders it colourless or communicates a violet tinge, according to the degree of oxydation.

Unites also, by fusion, with Sulphur, into a yellowish-green mass. By mixture with unctuous substances, sometimes occasions inflammation.

Combines in the metallic state with most of the other Metals, rendering Gold and Iron more fusible,—Copper less.

Order of attraction in the moist way, *Oxalic Acid, Citric, Phosphoric, Tartaric, Fluoric, Muriatic, Sulphuric, Nitric, Saccho-lactic, Succinic, Sebacic, Arsenic, Formic, Lactic, Acetic, Prussic,* and *Carbonic;* in the dry way, *Copper, Iron, Gold, Silver, Tin, Alkaline Sulphurets.*

Employed principally in Glass-making and Bleaching.

Of Tungsten, or *Wolfram.*

Found 1*st.* in the state of an Acid, in combination with Lime, *Tungstate of Lime;* and 2*d.* with Oxyd of Manganese and of Iron, Silex, and Tin, *Wolfram.*

Colour steel-grey. Texture granular. Extremely hard. Sp. Gr. 17.6.

Nearly infusible, requiring a heat at least equal to 170° *Wedg.*

Yields a yellow Oxyd, *(Acid of Tungsten,)* which in close vessels becomes blue or black.

Insoluble in the Sulphuric, Nitric, and Muriatic Acids. Slightly soluble in the Oxy-muriatic.

[illegible] in the metallic state with most of the other Metals, rendering [illegible] and [illegible] brittle. — Copper less.

[illegible]

[illegible]

[illegible]

[illegible] in the state of an Acid, in combination with Lead. [illegible] of Zinc and [illegible] of Manganese [illegible] Iron [illegible] and [illegible].

[illegible] granular. [illegible] Sp. Gr. [illegible]

[illegible]

[illegible]

Combines with the other Metals. Does not lessen the ductility of Silver or Copper; but renders Iron, Tin, Bismuth, Antimony, and Manganese harder.

Order of attraction in the moist way, *Lime, Potash, Ammonia;* in the dry way, *Potash, Lime, Iron, Manganese.*

Not as yet applied to any use.

Of Uranium.

Found 1*st.* in combination with Sulphur, *Pechblende; 2d.* with Oxygen, (on the surface of the former,) *Yellow Oxyd;* and 3*d.* with Carbonic Acid and a little Copper, *Calcolite.*

Has been but imperfectly reduced.

Appears capable of uniting with several of the Acids.

Its Oxyds tinge glass of various colours, brown, grey, and green.

Of Molybdena.

Found in combination with Sulphur.—Formerly confounded with Plumbago.

Hitherto obtained only in agglutinated grains.

Colour, externally whitish yellow, internally grey. Sp. Gr. 7.5. Brittle.

Less fusible than either Platina or Manganese.

According to the experiments of Mr. Hatchett, is capable of combining with four different portions of Oxygen, producing a black, a blue, a green Oxyd, *(Molybdous Acid,)* and a yellow or white *(Molybdic Acid)*.

When combined with Iron, Copper and Silver, renders them friable.

In union with Sulphur regenerates *Sulphuret of Molybdena.*

Order of attraction unknown.

Not yet applied to any use.

Of Titanium.

Found combined with Oxygen in the *Red Schorl* of Hungary; and in *Menachanite.*

Of a colour somewhat resembling Copper. Appears to be infusible, but capable of being volatilized.

Difficultly oxydated by any of the acids.

With Iron forms a compound of a gold colour internally.

Forms Salts with either Potass or Ammonia.

According to Berzelius [illegible] is capable of combining with four different proportions of Oxygen, producing a black, a blue, a green [illegible] and a yellow [illegible].

When combined with Iron, Copper [illegible] [illegible]

[illegible] of Molybdena.

Oxide of [illegible]

Not [illegible] applied to any use.

Tungsten.

Found combined with Oxygen in the [illegible] state of [illegible] and in [illegible]

[illegible] Copper. Appears to be infusible, but capable of being [illegible]

[illegible] acted on by any of the acids.

When this Oxide is [illegible] a yellow [illegible]

Of Tellurium.

Found in several of the Ores of Gold; and in considerable proportion.

Of a whitish-leaden colour; metallic lustre; laminated texture; very brittle; Sp. Gr. 6.115.

Of all metallic substances the *most fusible* except Quicksilver, like which it may be sublimed in brilliant globules.

Burns with a bluish-green flame. Soluble in the Nitric, Muriatic, and Sulphuric Acids; from which it may be precipitated by Alkaline Sulphurets in the form of a powder, in appearance much resembling Kermès Mineral.

Said to be the only metal, except Gold, Platina, and Antimony, which is not precipitated from its solutions by Alkaline Prussiates.

Its Oxyds so rapidly reduced on heated Charcoal as to occasion actual detonation.

Of Chrome.

Found 1*st.* in the state of an Acid, combined with Oxyd of Lead, *Red Lead of Siberia*; and in a similar acid state in the *pale Red Ruby*; 2*d.* with Oxygen, in the *green Emerald of Peru*; 3*d.* in the *Meteoric Stones.*

May be obtained in a concrete acid state, and of a red colour, from the two first, by treatment with Carbonate of Potash; or in the form of a green Oxyd, from the last, by treatment with Muriatic Acid.

Has as yet been but imperfectly reduced.

Of a greyish-white colour; very hard; very brittle; and very difficult of fusion.

Not soluble in the Muriatic or Sulphuric Acids; and difficultly in the Nitric and Oxymuriatic.

Combined, in its Acid state, with Muriatic Acid, is capable of dissolving Gold.

Of Columbium.

Discovered some years ago in an Acid state by Mr. Hatchett, in a dark grey mineral, sent with some iron ore from America, and which appears to consist of more than three-fourths of this acid combined with iron. Its colour in this state is white; it reddens litmus paper; is insoluble in boiling Nitric Acid, but soluble in Sulphuric Acid when strongly heated, and also, when recently separated from Potash, in boiling Muriatic Acid.

It gives colourless solutions with Acids and Alkalies; is precipitated from its acid solutions

May be obtained in a concrete acid state and of a red colour, from the two first, by treatment with Carbonate of Potash; or in the form of a green Oxyd, from the last, by treatment with Muriatic Acid.

Has not yet been but imperfectly reduced.

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Combined, in its acid state, with Muriatic Acid, is capable of dissolving Gold.

Of Columbium.

Discovered some years ago in an Acid state by Mr. Hatchett, in a dark grey mineral, sent with some iron ore from America, and which appears to consist of more than three fourths of this acid combined with iron. Insoluble in this state in water; it reddens litmus paper; is insoluble in boiling Nitric Acid, but soluble in Sulphuric Acid when strongly heated, and also when previously combined with Potash, in boiling Nitric Acid.

It [illegible] forms combinations with Soda and Ammonia; [illegible] by Alkalies in white flocculi, by Prussiate of Potash of an olive-green colour, and by Tincture of Galls of a deep orange.

Is extremely difficult of reduction.

The supposed new metal called Tantalum, discovered by Mr. Ekeberg in the mineral called Tantalite, shewn by Dr. Wollaston to be identical with Columbium.

Of Cerium.

and easily decomposed by a strong heat. May be obtained in the state of white or red Oxyd. Both these Oxyds soluble in Sulphuric Acid. The white Oxyd is soluble in the Nitric, and the red Oxyd is not soluble in the Muriatic Acid. The salts of Cerium have a Saccharine taste. This metal can hardly be said to have been obtained in the metallic state. Appears to be volatile at high temperatures.

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Is extremely difficult of reduction.

The supposed new metal called *Tantalium*, discovered by Mr. Ekeberg in the mineral called *Tantalite*, shewn by Dr. Wollaston to be identical with *Columbium*.

Of Cerium.

Lately discovered in a copper-mine in Sweden. May be obtained in the state of white or red Oxyd. Both these oxyds soluble in Sulphuric Acid. The white oxyd most soluble in the Nitric, and the red oxyd most soluble in the Muriatic Acid. The salts of Cerium have a Saccharine taste. This metal can hardly be said to have been obtained in the reguline state. Appears to be volatile at high temperatures.

ORGANISED BODIES,

Form two classes of compounds, *Vegetable* and *Animal*, consisting nearly of the same constituent principles or elements, but in different proportions.

The chemical affinities of the constituent parts of both, essentially modified by the *Living Principle.*

Vegetable Substances.

Their *Ultimate Elements* are, Carbon, Hydrogen, and Oxygen, which are all furnished by Analysis. Air and Water the principal sources of these. They also contain Saline, Earthy, and Metallic matter; the latter in small quantity.

Manures. How they promote vegetation.

Circumstances in which Vegetable substances differ from Animal matter.

ORGANIZED BODIES.

[illegible] the [illegible] of compounds (Vegetable and Animal), consisting mostly of the [illegible] elementary principles [illegible], having different proportions.

The chemical affinities of the [illegible] parts of both [illegible] modified by [illegible] living Principle.

Vegetable Substances.

These contain Starch, Gum, Cotton, [illegible], and Oxygen, [illegible] all [illegible] Ammonia. Air and Water the principal sources [illegible] as food. They also contain Salts, [illegible] and Metallic Oxides, the latter in small quantity.

Manures. How they promote vegetation.

[illegible] in which Vegetable substances differ from Animal matter.

~~Cork is the bark of Quercus suber.~~

Russian Leather is tanned with willow bark and the peculiar smell which is occasioned by Birch Oil.

Morocco leather is made by the colouring matter being applied to it after the tanning process.

The *Proximate Ingredients*, or immediate productions of vegetables are, *Cork*, *Woody-fibre*, *Tan*, *Colouring Matter*, *Extract*, *Oils*, *Resins*, *Wax* and *Tallow*, *Camphor*, *Gum*, *Jelly*, *Gluten*, *Albumen*, *Caoutchouc*, *Starch*, *Sugar*, *Native Salts* and *Earth*.

Several of these already spoken of.

Cork,—the exterior part of the *Quercus Suber*, a substance *sui generis*. Yields *Suberic Acid* by treatment with the Nitric Acid.

Woody-fibre, or *Lignin*,—the substance which is left after the digestion of ligneous matter in Water and Alcohol.

Tan,—contained in all astringent vegetable substances, but most plentifully in Catechu and the Gall Nut, from the concentrated infusions of which it may be precipitated by Carbonate of Potash or by Acids. When dry is of a brown colour, brittle, of a very astringent taste, very soluble in Water, and still more so in Alcohol. Forms an insoluble compound with Glue, and produces a deep blue precipitate when added to the solution of Oxy-sulphate of Iron. On distillation, yields an Acid Liquor, a small proportion of Empyreumatic Oil, and about one-thirty-eighth part of its weight of Charcoal.—Mr. Hatchett's *artificial Tanning*.

Colouring Matter,—that part of Vegetable Substances which is attracted by the fibres of Silk, Linen, Wool, &c. in the act of dyeing.—*Mordants;* their nature and use explained.—Differs in its other properties according to the subject from which it is obtained.

Extract,—obtained from the watery infusions of many plants, such as Saffron, Liquorice, &c. by evaporating them to dryness. Distinguishable from all other vegetable substances by being soluble both in Water and in Alcohol, but not in Sulphuric Æther.

Gum,—procured most plentifully from certain species of *Mimosa.* When pure, colourless, insipid, soluble in Water, but not in Alcohol or Oils.—Not prone to decomposition by keeping.—Soluble in the Vegetable Acids without alteration, but decomposed by the Mineral. 100 parts said to consist of 65.38 Oxygen, 23.08 Carbon, and 11.54 Hydrogen.—An article of the Materia Medica; useful also in divers manufactures, particularly in Calico-Printing.

Jelly,—obtained from the expressed juice of Currants, and many other fruits, in the form of Coagulum, by allowing the juice to remain for some time at rest, decanting off the thinner part, and washing the remainder in a small

Wool, silk, cotton, hemp, and flax lie or are arranged in the same order they are placed for colouring matter.

This attraction has given rise to the art of dyeing

Alum and Muriate of Tin are the chief mordants.

Colour Infusion of Cochineal produces a deep purple color in silk - In water [illegible] - When Muriate of Tin is used - the color becomes red - with the ~~[illegible]~~ Tartar of dyes [illegible] from wine a very bright red -

Carmine is obtained from Cochineal precipitated by Muriate of Tin.

[illegible]

quantity of Water only. This [illegible] is [illegible], insipid, and of a [illegible] consistence. Soluble in hot water, but [illegible] on cooling.—When dried, [illegible] Combines readily with [illegible] Bases, and is converted into Cheese.

Gluten.—the grey coloured [illegible] and substance which is left [illegible] washing the paste of Wheat flour [illegible] of Water. It is [illegible] in part in.—When dried [illegible] having nearly [illegible] in the acids, and in solutions of the Alkalies by the assistance of heat.—Insoluble in Water, Alcohol, Æthers and Oils.—Differs from other Vegetable substances, [illegible] and matter in [illegible].

Albumen.—[illegible] white of egg.—[illegible] boiling heat. [illegible] of [illegible] of juice, [illegible] and [illegible] [illegible] Water. [illegible] quantity of water.—In this State is inodorous, tasteless, and of a tremulous consistence.—Soluble in hot water, but again coagulated in cooling.—When dried becomes transparent.—Combines readily with Alkalies, and by the Nitric Acid is converted into Oxalic.

Gluten.—the grey coloured tenacious and insipid substance which is left behind in washing the paste of Wheaten Flour in repeated portions of Water. In its moist state much disposed to putrefy.—When dried resembles Glue.—In boiling water loses its tenacity.—Soluble in all the acids, and in solutions of the Alkalies by the assistance of heat.—Insoluble in Water, Alcohol, Æthers and Oils.—Differs from most other Vegetable substances, and resembles Animal matter in containing Azote.

Albumen,—so called from its resemblance to white of egg.—Obtained by exposing to a boiling heat, the water employed in the preparation of Starch from flour, or the depurated expressed juice of Scurvy grass, Cresses, Cabbages, and most other cruciform plants.—Separates at this temperature in the form of Coagulated Flakes.—Is also precipitated from its watery solutions by Alcohol and Acids.—When dried quantity of water.—In this state is nearly colourless, and of a tremulous consistence.—Soluble in hot water, but again coagulated in cooling—When dried becomes transparent.—Combines readily with Alkalies, and by the Nitric Acid is converted into Oxalic.

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Caoutchouc,—the inspissated milky juice of certain trees, the *Hævea Caoutchouc, Iatropha Elastica,* and others growing chiefly in South America. When fresh is of an ash colour; without taste or smell.—Very elastic.—Sp. Gr. 0.933.—Not altered by Air.—Perfectly insoluble in Water.—Soluble in rectified Petroleum, Volatile Oils, and in pure Æther; but not in Alcohol.—Is decomposed, with the assistance of heat, both by the Sulphuric and Nitric Acids, but is not affected by Alkalies.—Melts readily when heated, yields Ammonia in distillation, and in the open fire burns with a white flame.

Starch,—the grey or white sediment deposited by Wheaten Flour, Potatoes, and various other vegetable substances, after diffusion in water.—Has scarcely any smell, and but little taste; though insoluble in cold Water, combines with it by boiling into a kind of Mucilage.—Altogether insoluble in Alcohol, and not readily acted on by diluted Acids; but soluble without decomposition by Alkalies, unless when they are concentrated and heat employed. By destructive distillation yields a large proportion

The mode of making Elastic bougies over by Despelly begin and decreasing moulds to it till they become a proper state

The syrup the sugar cane is pressed & [illegible] till

with some water forms a very clear liquor is

drawn off and evaporated down

It is afterwards clarified by solution and using

Albumen which combines with all the impurities

and forms a scum which is separated - this

then evaporated poured into moulds and by

imperfect crystallization forms loaf sugar

the color is then abstracted by filtering the bases

the loaf up - covering them with clay allowing water

to drain thro' it which washes away the coloring

matter and leaves it quite white.

The new & perfect mode of clarifying is by the

evaporating of with so great a heat by the use of the

Air pump under the exhausted receiver of the Air of Carbon. Supposed to be converted into Sugar in the process of Malting.

Sugar,—the produce of the *Arundo Saccharifera* or *Sugar Cane, Sugar Maple, Beet, Carrot, Grape,* and many other vegetables.—When purified, of a white colour, sweet, inodorous, not subject to alteration by exposure to Air; very soluble in water, and crystallizable; soluble also in Alcohol, but not in so large a proportion.—Readily decomposed both by the Sulphuric and Nitric Acids; in the weaker Acids merely soluble.—Forms with Potash a bitter astringent compound, insoluble in Alcohol; forms a similar one with Lime. On decomposition by heat, yields Water, Carbonic Acid, Carbonated Hydrogen Gas, Empyreumatic Oil, Acetous Acid, and Charcoal.—100 parts consist, according to Lavoisier, of 64 Oxygen, 28 Carbon, and 8 Hydrogen.

Artificial Sugar from Starch and very dilute Sulphuric Acid. Late improvements in the refining of Sugar.

Animal Substances.

These are formed of the same *Ultimate Elements* as vegetables, but they yield in general, by analysis, Ammonia, and therefore contain Azote, a substance not essential to vegetable matter. A variety of other substances occasionally met with in animal matter.

Their *Proximate Principles* and productions are, *Fibrine, Albumen, Gelatine, Mucilage, Urea, Sugar, Oils, Resins, Sulphur, Phosphorus, Acids, Alkalies, Earths, Metals.*

Fibrine,—often called coagulable lymph, is the substance which remains on washing crassamentum of blood in successive portions of water, till it cease to give out any colour. Bears a strong resemblance to muscular fibre; is white, tasteless, soft, ductile, elastic, insoluble either in Water or Alcohol; in boiling water becomes hard and inelastic; in its soft state much disposed to putrify; by long digestion in water is converted into a particular species of tallow.—Soluble in most of the Acids, and in the stronger solutions of both the fixed Alkalies, with which, by the assistance of heat, it of blood that fluid circulating thro the body - when allowed to stand coagulates - separates into two parts serum & coagulum - if the coagulum be washed in a linen cloth under a stream of water the red particles are washed away - and a colourless substance remains formerly called gluten now fibrin - in some diseases the fibrin separates spontaneously which is called a buffy coat a sign of inflammation - another mark of inflammation is a contraction of the edges of the coag. which is called cupped. The fibrin [illegible] of blood when [illegible] - is tough & elastic - by heat contracts [illegible] when left to putrefy. The liquid separated from the coag. is called serum - chemically Albumen -

When Albumen exposed to a heat of 160 or 70 degrees coagulates - soluble in water - from the solution it may be coagulated by heat - acids - Alkalies - & some oxides of the Metals - If the quantity of water be very large only a turbid appearance takes place. It bears an exact resemblance to the white of Egg. The most delicate test of Albumen is a solution of corrosive sublimate - put gr. j in ℥j of water add a little of the solution and a milky appearance takes place. Solutions of Tin are good tests. Albumen forms a considerable part of many of the solids - when once coagulated insoluble in water - but partially soluble in caustic Alkali.

Specific gravity 1,029. { From 1,024 to 1,034 [1015]

The serosity or that part which oozes from coagulated Serum - contains Soda - Muriate of Soda - &c. contains gr. i of Salts in 100 gr. of Serum.

The Specific gravity of the blood very different under different circumstances. This probably may be hereafter discovered to have some connection with disease.

The colouring matter - called red globules - are found to contain oxide of Iron.

Fibrine composes the 3 oo part of the Blood -

Dr Marcet has named serosity mucous extractive matter

It contains Mur of Sod of Potash & of lime with Iron in the state of Phosphate

Serum only contain one part in ten of Albumen the rest is water -

Mr Brande contends that the red particles do not contain more iron than albumen. Berzelius however states that they do contain much more. Phosphate of Iron does not colour any thing red -

Berzelius has proved that gelatine is not to be found in the blood -

forms a viscid bitter soap. In distillation yields a large proportion of Ammonia.

Albumen,—contained in the serum of blood, and in various other animal substances; most abundantly in white of egg. In its moist and fresh state is nearly without colour, taste or smell—viscid—readily soluble in cold water—distinguishable from other animal fluids by coagulating at a temperature of about 165° *Farenh.*—Acids and Alcohol produce on it a similar effect.—Conjectures on the cause of this property.—When coagulated is insoluble in water.—Tan added to its aqueous solution, forms with it a copious yellow coloured tenacious precipitate, which, when dried, is brittle, and not susceptible of putrefaction.—Albumen soluble in Alkalies and Alkaline Earths.—In distillation yields the same products as Fibrine, but with a less proportion of Ammonia. Tests of the presence of Albumen. The fluid called *Serosity,* essentially different from Albumen.

Gelatine,—or Jelly, obtained by boiling certain animal substances, particularly skin, in common water, evaporating the decoction to the necessary degree of consistence, and allowing it to cool.—When pure, transparent and colourless. Soluble both in cold and hot water, very readily in the latter, even at a temperature of 90° *Farenh.* By drying becomes semi-transparent, hard, brittle, and of a vitreous fracture, Glue.—Is insoluble in Alcohol; Alkalies require the assistance of heat, but Acids dissolve it with great facility, even when diluted.—With Tan it forms, like Albumen, a yellowish coloured plastic compound, insoluble in water, and not susceptible of putrefaction; hence the theory of *Tanning.*—Heat decomposes it like other animal substances.

Mucus,—nature of this substance not yet well understood. Is distinguished from the other animal fluids by negative rather than by positive criteria. When exposed to the action of a voltaic pile, gives out Alkali at one pole, and a coagulated substance at the other.

Pus,—a morbid secretion, formed from various other animal fluids, of the nature of which it more or less partakes.—Not distinguishabe with perfect certainty by any chemical test yet discovered.

Urea,—procured from fresh Urine in the form of small crystalline plates, by evaporating it to the consistence of syrup, digesting this when cold in Alcohol, distilling the solution so as to separate and collect the spirit, and allowing the

Urinary Calculi

The most common Calculus is call'd the Lithic Calculus first examined by Scheele who certainly proved [illegible] the only one to which the [illegible] been subject. Its appearance [illegible] is brown or reddish brown color - concentric layers looking something like mahogany.

Drop a little of the stone into a glass, add a solution of caustic potash and it will be dissolved - and by pouring acid on it will again be precipitated - When any of the powder is dissolved in water [illegible] being [illegible] by nitric acid the solution turns litmus paper red - [illegible] a little in [illegible] would [illegible] [illegible]

Phosphate of Lime is a very rare calculus consists of concentric layers - and also of fibres [illegible] from centre to circumference - does not [illegible] under the action of the blow pipe - [illegible]

The Ammoniaco-Magnesian Phosphate - has a crystalline appearance when examined with a [illegible]

The triple Phosphate consists of the Ammon. [illegible] with Phosphate of Lime. This is fused under the blow-pipe - becoming quite a globule - [illegible] Ammon

or the Lithic Acid - its solubility in acid is another acid (Muriatic acid) to the solution of oxalate of Ammonia - and an oxalate of Lime is precipitated -
The Mulberry calculus is the least soluble - insoluble in Acids - and in Alkalies - it is decomposed by the blowpipe or by exposure to heat - being composed of oxalate of lime the heat expels the oxalic acid is driven off and quick lime remains which turns turmeric paper red - while infusion of litmus paper held over is changed to red also.
Calculi often compound which renders medicinal treatment difficult.
The outline of medical treatment is simple being determined by their solubility in Acids & Alkalies - these only be used either by injection and mouth - tho' injecting has not been found successful without the bladder much
Dr Marcet tried it in a case in Guy's Hospital he would been 5 Dr of [illegible] had [illegible] to be injected and the stone was partially dissolved as its compound was found in the urine

There is no test that will certainly dis-
tinguish pus from other animal flui[ds]
Dr Young's is best – putting a drop of sus-
pected fluid between two plates of glass –
if it be looked at in a strong light – the pus
which has globules in it will form a very [illegible]
the glass and the globules seen. Yet Cream
will exhibit the same phenomena.

Dr Prout has made some enquiries
into the nature of Urea - Sugar - Lithic Acid
Urea - 2 Hydrog: 1 Carbon - 1 Oxygen - 1 Azote
Sugar 1 Hyd: 1 Carbon - 1 [illegible] Oxygen -
Lithic Acid 1 H. 2 C. 1½ Oxygen - 1 Azote

residuum to crystallize by cooling. Thus obtained, its colour is yellowish white, smell alliaceous, taste strong and ammoniacal, consistence viscid, extremely soluble in Water, somewhat less so in Alcohol, soluble also in the aqueous solutions of both the Fixed Alkalies and in a Marine Acid.—When perfectly pure is quite colourless, and free from smell.—By the Sulphuric and Nitric Acids it is decomposed, as it is likewise very easily by exposure to heat, even to that of boiling water. According to Vauquelin, 100 parts yield in distillation 92.02 Carbonate of Ammonia, 4.60 Carbonated Hydrogen Gas, and 3.22 Charcoal.

Urea bears no resemblance to *Uric Acid*, a substance of which the most common species of urinary concretion chiefly consist.

Urinary Calculi.—Mode of analysing them.—Their different species and varieties.—Conclusion of the Course.

THE END.

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A VIEW
OF THE
SIMPLE BODIES*

CLASS I.

(Comprehending the Imponderable Agents, viz.)

CALORIC, or HEAT,
LIGHT,
ELECTRICITY.

CLASS II.

(Comprehending the Agents capable of uniting with Inflammable Bodies, and in most instances of effecting their Combustion, viz.)

OXYGEN,
OXY-MURIATIC ACID, or CHLORIC GAS.
IODINE.

CLASS III.

(Comprehending the Simple Combustible Bodies, or Bodies capable of combining both with Oxygen, and with Chloric Gas, viz.)

HYDROGEN, ...	or *basis of Water.*
NITROGEN, ...	*basis of Nitric Acid.*
CARBON, ...	*basis of Carbonic Acid.*
SULPHUR, ...	*basis of Sulphuric Acid.*
PHOSPHORUS, ...	*basis of Phosphoric Acid.*
BORACIUM, ...	*basis of Boracic Acid.*
FLUORIUM, ...	*basis of Fluoric Acid.*
POTASSIUM, ...	*Metallic Bases of the Alkalies.*
SODIUM, ...	
AMMONIUM,†	

CALCIUM,	YTTRIUM,	*Metallic Bases of the Earths.*
MAGNIUM,	GLUCIUM,	
STRONTIUM,	ZIRCONIUM,	
SILICIUM,	BARIUM,	
ALUMIUM,		

PLATINA,	BISMUTH,	MOLYBDENUM,	*Metals.*
GOLD,	NICKEL,	TITANIUM,	
PALLADIUM,	ARSENIC,	TELLURIUM,	
SILVER,	COBALT,	CHROMIUM,	
MERCURY,	ZINC,	COLUMBIUM,	
LEAD,	ANTIMONY,	CERIUM,	
COPPER,	MANGANESE,	OSMIUM,	
IRON,	TUNGSTEN,	IRIDIUM,	
TIN,	URANIUM,	RHODIUM.	

* By denominating bodies *Simple*, it is not meant to express that they are so in reality, but only that we have not hitherto been able, by any chemical means with which we are acquainted, to decompose them into simpler parts.

† Ammonium is strongly suspected of being a compound; but as its nature has not yet been positively ascertained, it may still be classed amongst the simple bodies. The same may be said of sulphur and phosphorus.