THE

EDINBURGH

NEW DISPENSATORY.

PART I.

ELEMENTS OF PHARMACY.

1. THE object of Pharmacy is to provide those substances which may be employed for the prevention or cure of disease.

2. To obtain this object completely, an acquaintance with the physical and chemical properties of these bodies is necessary. This may be termed the *Science of Pharmacy.*

3. Few substances are found in nature in a state fit for their exhibition in medicine. The various preparations which they previously undergo constitute the *Art of Pharmacy.*

4. Pharmacy is so intimately connected with Chemistry, that the former can neither be understood as a science, nor practised with advantage as an art, without a constant reference to the principles of the latter. For this reason, it is proper to premise such a view of the general doctrines of chemistry, and of the most remarkable properties of chemical agents, as is necessary for the purposes of pharmacy.

SECT. I.

EPITOME OF CHEMISTRY.

5. The most minute particles into which any substance can be divided, similar to each other, and to the substance of which they are parts, are termed its *Integrant particles.*

6. The most minute particles into which bodies can ultimately be divided are called their *Elementary particles.*

7. When the integrant particles admit of no further division, the body is a *Simple Substance.*

8. But the integrant particles of most bodies can be subdivided into other particles, differing in their nature from each other, and from the body of which they are parts. These are *Compound Bodies.*

9. If the particles, of which the integrant particles of any compound body are composed,

- *a.* admit of no further division, the body is a *Primary Compound;*
- *b.* but if they be also compound, and admit of still further subdivision, they are called *Intermediate particles,* and the body is a *Secondary Compound.*

10. Therefore the integrant particles

- *a.* of simple substances are also their elementary particles;
- *b.* of primary compounds are composed of elementary particles;
- *c.* of secondary compounds are composed of intermediate particles.

11. The phenomena of matter are regulated by attraction and repulsion.

ATTRACTION.

12. *Attraction* comprehends those forces which cause bodies to approach towards each other.

13. It operates

- *a.* at sensible distances, as in the attractions of *gravity, electricity* and *magnetism;*
- *b.* at insensible distances; *Contiguous Attraction.*
  - *a. a.* between particles of the *same* species, constituting the attraction of *cohesion* or *aggregation;*
  - *b. b.* between particles of *different* species, the attraction of *composition* or *affinity.*

REPULSION.

14. *Repulsion* tends to separate bodies from each other.

15. It also operates either

- *a.* at sensible distances, as in the repulsion of *electricity* and *magnetism;* or,
- *b.* at insensible distances, as in the repulsion of the matter of heat or *caloric.*

16. The phenomena resulting from the operation of attractions, and repulsions at insensible distances, constitute the proper objects of chemistry.

GRAVITY.

17. The most general species of attraction is that by which masses of bodies tend to approach each other.

Light, heat, electricity and magnetism alone, seem to be exempted from its influence. Hence those substances have been called, though not correctly, *Imponderable*.

a. Gravity acts in the direct ratio of the quantity of matter, and in the inverse ratio of the square of the distance.

b. It is indestructible and uniform.

c. It has no antagonist repulsion.

d. In free space it acts equally on all kinds of matter.

e. In gravitating media, it is different with respect to different kinds of matter; and the relative weights of equal masses of bodies constitute their *Specific Gravity*; water being commonly assumed as unity for solids and fluids, and hydrogen gas sometimes for airs and vapours.

f. The proportions in which bodies unite, seem to be multiples of the specific gravity of their elementary particles.

AGGREGATION.

18. Gravitating bodies exist under different forms of aggregation:

a. Solid, in which the attraction of cohesion resists relative motion among the particles, more or less perfectly, and the fragments are angular, and do not reunite on being placed in contact.

b. Fluid, in which it admits of relative motion among the particles, with greater or less facility, and small portions have a tendency to assume a globular form, and readily reunite on coming into contact.

c. Gaseous, in which the particles repel each other.

AFFINITY.

19. Affinity is regulated by the following laws:

a. It does not act at sensible distances.

b. It is exerted only between particles of different species.

c. It is exerted by different bodies, with different degrees of force; and hence it was called *Elective Attraction.*

d. It unites bodies in definite proportions; and when bodies combine in more proportions than one, these are multiples of each other. Also when more than two bodies unite, they exist in the same proportions, or multiples of the same proportions in which they form binary compounds. Lastly, when oxygenized bodies are combined, each of them contains the same quantity of oxygen, or multiples of the same quantity; and oxygenizable bodies combine in such proportions as will require equal or multiple quantities of oxygen for their oxygenizement.

e. It unites a first proportion of one body with another, more strongly than a second; a second than a third, and so on; and hence it is in the inverse ratio of saturation, and seems to increase with the mass.

f. It is influenced by cohesion, specific gravity, elasticity and temperature.

g. It is often accompanied by a change of temperature.

h. Substances, chemically combined, acquire new properties;

i. and cannot be separated by mechanical means.

k. The action produced by different affinities, existing in one substance, is called *Resulting Affinity.*

20. Affinity is

a. simple, when two bodies unite, in consequence of their mutual attraction, whether these bodies be themselves simple or compound, and even although, in the latter case, it be attended with decomposition.

b. compound, when there is more than one new combination, and when the new arrangement would not have taken place, in consequence of the attractions tending to produce either combination singly.

21. The attractions which tend to preserve the original arrangement of bodies presented to each other are denominated *Quiescent Attractions;* those which tend to destroy the original, and to form a new arrangement, are termed *Divellent attractions.*

It is evident that no new arrangement can take place, unless the divellent be more powerful than the quiescent attractions.

CLASSIFICATION OF SIMPLE SUBSTANCES, ACCORDING TO DR THOMSON.

22. Imponderable bodies.

Light.	Electricity.
Heat.	

Ponderable bodies.

Simple supporters of combustion:

Oxygen.	Iodine.
Chlorine.	Fluorine.

Simple incombustibles.

Azote.

Acidifiable combustibles.

Hydrogen.	Sulphur.
Carbon.	Arsenic.
Boron.	Tellurium.
Silicon.	Osmium.
Phosphorus.	

Intermediate combustibles.

Antimony.	Tungsten.
Chromium.	Columbium.
Molybdenum.	Titanium.

Alkalifiable combustibles.

Potassium.	Barium.
Sodium.	Strontium.
Calcium.	Magnesium.

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Yttrium.	Zirconium.
Glucinum.	Thorinum.
Aluminum.	

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Iron.	Manganese.
Nickel.	Cerium.
Cobalt.	Uranium.

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Zinc.	Bismuth.
Lead.	Mercury.
Tin.	Silver.
Copper.	

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Gold.	Rhodium.
Platinum.	Iridium.
Palladium.	

COMPOUND BODIES.

23. Compound bodies may be divided into

a. Primary compounds (9. *a*), consisting of simple substances combined with each other. These may be subdivided into binary, ternary, quaternary, &c. according to the number of their constituents.

b. Secondary compounds, (9. *b*), consisting of compound bodies combined with simple bodies, or with each other.

This division is convenient, but arbitrary, as we are in fact ignorant of what are really simple bodies, and cannot ascertain the manner of combination in bodies compounded of three or more elements.

LIGHT.

24. Light emanates in every direction from visible bodies.

25. It moves in straight lines, with a velocity equal to 164,000 miles in a second.

26. Its gravity is not appretiable.

27. When a ray of light passes very near a solid body, it is *inflected* towards it.

28. When it passes at a distance somewhat greater, it is *deflected* from it.

29. When a ray of light falls upon a polished surface, it is *reflected* from it, and the angle of reflection is equal to the angle of incidence.

30. Some bodies have the property of polarizing and others of depolarizing light.

31. Bodies which do not allow light to pass through them are termed *Opaque.*

32. Those which allow it to pass freely through them are termed *Transparent.*

33. When a ray of light passes obliquely from one medium into another of greater density, it is bent towards the perpendicular; but if the second medium be of less density, it is bent from the perpendicular. The light, in both cases, is said to be *Refracted.*

34. The refracting power of bodies is proportional to their densities, except with regard to inflammable bodies, of which the refracting power is greater than in proportion to their densities.

35. By means of a triangular prism, light is separated by refraction into seven coloured rays; red, orange, yellow, green, blue, indigo, and violet.

36. These rays are permanent, and suffer no further change by reflection or refraction.

37. They differ in flexibility and refrangibility; the red possessing these properties in a less degree than the orange, the

orange than the yellow, and so on in the order of their enumeration.

38. The *illuminating power* of the different rays is greatest between the yellow and green, and gradually declines towards both ends of the spectrum.

39. The different colours of bodies depend on their transmitting or reflecting those rays only which constitute their particular colours.

40. White consists of the whole prismatic rays united.

41. Black is the total absence of light, or complete suffocation of all the rays.

42. The sun's rays possess the power of heating bodies.

43. The *heating power* of the different rays is inversely as their refrangibility. But as this power is greatest at some distance beyond the red end of the visible spectrum, it is probable that it is totally independent of the calorific rays.

44. Bodies are heated by light inversely as their transparency, and directly as the number of rays suffocated by them.

45. The sun's rays possess the chemical property of separating oxygen from many of its combinations.

46. The *disoxygenizing power* of the different rays is in proportion to their refrangibility. But as this power is greatest at a small distance beyond the violet end of the visible spectrum, it is probable that it is totally independent of the colorific or calorific rays.

47. Light is absorbed by many bodies, and again emitted by them in the dark.

48. The sources of light are the sun's rays, phosphori, combustion, combination, heat, and percussion.

49. Light is supposed by some to exist in a latent state in all combustible bodies.

CALORIC.

50. Heat, in common language, is a term employed to express both a certain sensation, and the cause producing that sensation. In philosophical language, it is now confined to the sensation, and the term *Caloric* has been adopted to express the cause.

51. The particles of caloric repel each other: it is therefore disposed to fly off in every direction from a body in which it is accumulated, or to pass off by radiation.

52. Caloric is attracted by all other bodies. It has therefore an irresistible tendency so to distribute itself as to produce an universal equilibrium of temperature, or to pass from bodies in which it is accumulated, into bodies in which it is

deficient, until the attraction of each for caloric, and the repulsive force of the caloric contained in each become equal to each other.

53. Caloric is radiated most slowly by polished metallic surfaces, and most quickly by rough blackened surfaces.

54. Radiated caloric is admitted most readily by rough blackened surfaces, and most difficultly by polished metallic surfaces.

55. Radiated caloric is transmitted with the velocity of light; and is, in like manner, reflected and refracted.

56. But the passage of caloric through most bodies is immensely slower than radiated caloric.

57. When caloric moves through bodies with this diminished velocity, it is said to be conducted by them. Metals are the best conductors; then stones, glass, dried wood. Spongy bodies, in general, are bad conductors. Fluids also conduct caloric; but as they admit of intestine motion among their particles, they carry it more frequently than they conduct it.

58. *Temperature* is that state of any body, by which it excites the sensation of heat or of cold, and produces the other effects which depend on the excess or deficiency of caloric.

59. The most general effect of caloric is *expansion;* the only real exception to this law being the contraction of water, from the lowest temperature at which it can remain fluid, to 42° 5′ F. This expansion either consists,

a. in a simple increase of volume; or

b. it produces a change of form in the substance heated.

a. a. from solid to fluid; *fusion, liquefaction.*

b. b. from solid or fluid to vapour; *vaporization.*

60. Bodies expand gradually, and at all temperatures, so long as they undergo no other change.

61. Bodies differ very much in the degree of gradual expansion, (59. *a*) which equal increments of temperature produce in them. Gases are more expansible than fluids, fluids than solids. The individuals of the latter forms of aggregation also exhibit considerable differences.

62. The change of form (59. *b*) occurs suddenly, and always at certain degrees of temperature.

63. *Vaporization* is much retarded by increase of pressure, and facilitated by its diminution, insomuch, that those substances which, under the ordinary pressure of the atmosphere, seem to pass at once from the state of solid to that of vapour, may, by the application of sufficient pressure, be made to assume the intermediate state of fluidity; while, on the contrary, all fluids which have been hitherto tried, begin in a vacuum

to boil and to emit vapour, when their temperature is lower, by 120° at least, than their vaporific point, at the ordinary pressure of the atmosphere.

64. From analogy, all bodies are considered as solid when totally deprived of caloric; but they are termed solid, fluid, or gaseous, according to the state in which they exist at the ordinary temperature of the atmosphere. They are also termed fusible or infusible, volatile or fixed, condensible or permanently elastic, according to the effects of caloric upon them.

65. Another very general effect of caloric is *increased temperature*

a. This effect is constant when bodies retain their form of aggregation, or undergo the gradual species of expansion (59. *a*);

b. but while they undergo the sudden species, (59. *b.*) they remain at one determinate temperature, that necessary for their fusion or vaporization, until the change be completed throughout the whole mass.

66. During the time necessary to effect this, the influx of caloric continues as before; and as it does not increase the temperature, it is said to become latent or combined.

67. The caloric necessary for these changes (65. *b.*) is best denominated the caloric of fluidity, and the caloric of vaporization; and its quantity is determinate with regard to each substance.

68. The absolute caloric, or total quantity of caloric contained in any body, is perfectly unknown; but the quantity which increases the temperature of any body a certain number of degrees, is termed its specific caloric, (Capacity for caloric, of Black, Crawford, and others,) when its weight is the object of comparison; and by Dr Thomson, its capacity for caloric, when its volume is considered. The specific, and therefore the absolute caloric of bodies, varies very much.

69. *Incandescence* is the least general effect of caloric, as it is confined to those substances which are capable of supporting the very high temperature necessary for its production, without being converted into vapour or gas.

70. On the living body caloric produces the sensation of heat, and its general action is stimulant. Vegetation and animal life are intimately connected with temperature, each climate supporting animals and vegetables peculiar to itself.

71. Caloric influences affinity, both on account of the operation of its own affinities, and of its facilitating the action of bodies, by counteracting cohesion. For the latter reason, it also promotes solution, and increases the power of solvents.

72. The general effects of the abstraction of caloric, are *di-*

minution of volume, condensation, diminution of temperature, and *sensation of cold.* It also influences affinity, and, in general, retards solution. The abstraction of caloric never can be total; and the attempts to calculate the thermometrical point at which it would take place, although ingenious, are not satisfactory. Those most worthy of attention place it about —1500° F.

73. The means employed to increase temperature are, the rays of the sun, collected by means of a concave mirror, or double convex lens, electricity, friction, percussion, collision, condensation, and combustion. Temperature is diminished by rarefaction, evaporation, and liquefaction.

74. Temperature is estimated relatively by our sensations, and absolutely by means of various instruments. The thermometer indicates temperature by the expansion which a certain bulk of fluid undergoes from the addition of caloric, and by the condensation produced by its abstraction. Mercury, from the uniformity of its expansion, forms the most accurate thermometer; but for temperatures in which mercury would freeze, alcohol must be employed. Air is sometimes used to shew very small variations of temperature. The action of the pyrometer of Wedgwood, which is employed for measuring very high temperatures, depends upon the permanent and uniform contraction of pure clay at these temperatures.

ELECTRICITY.

75. The particles of the electric fluid repel each other, with a force decreasing as the distances increase.

76. They attract the particles of other bodies, with a force decreasing as the distances increase; and this attraction is mutual.

77. They are dispersed in the pores of other bodies, and move with various degrees of facility through different kinds of matter.

a. Bodies, through which they move without any perceivable obstruction, are called *Non-electrics,* or *Conductors.* Of these the chief are the metals, charcoal, and inflammable metallic compounds.

b. Bodies, through which they move with very great difficulty, are called *Electrics,* or *Non-conductors.* Of these the chief are glass, sulphur, oils, resins and compounds of the metals with oxygen or chlorine, (oxymuriatic acid).

c. Bodies through which they move, but with difficulty, are called *Imperfect Conductors.* Of these we have examples in alcohol and ether.

78. The phenomena of electricity arise

a. from the actual motion of the fluid from a body containing more, into another body containing less of it;

b. from its attraction or repulsion, independently of any transference of fluid.

79. By rubbing electrics on each other, the distribution of the electric fluid in them is altered. On separating them, the one contains more, and the other less than the natural quantity; or, the one becomes positively, and the other negatively electrified. Positive electricity is also called *vitreous*, and negative also *resinous*.

80. Electrics may also be excited by rubbing them with non-electrics.

81. If a body B be brought into the neighbourhood of an electrified body A, B becomes electrified by position.

82. If an insulated body B, that is, a body in contact with electrics only, be brought into the neighbourhood of an electrified body A, B becomes permanently electrified, and the electricity of A is diminished, while a spark passes between them accompanied by sound. If a metallic point be presented to a body negatively electrified, it emits rays of light; if to a body positively electrified, it becomes simply luminous.

83. When a body A has imparted electricity to another body B, they repel each other, unless B shall have afterwards imparted all its electricity to other bodies.

84. Bodies repel each other, when both are positively or both negatively electrified.

85. Bodies attract each other, when the one is positively and the other negatively electrified.

86. If either of the bodies be in the natural state, they will neither attract nor repel each other.

87. The electric spark is accompanied by intense increase of temperature, and will kindle inflammable bodies.

88. Electricity is disengaged during many chemical actions, and it produces very remarkable chemical effects, depending chiefly on sudden and momentary increase of temperature, and on the light produced.

89. Electricity acts on the living system as a stimulus.

GALVANISM.

90. The phenomena of galvanism seem to depend solely on

the agency of electricity, excited during certain chemical actions.

91. It is excited by arranging at least three heterogeneous bodies, two conductors and one imperfect conductor, or two imperfect conductors and one conductor, in such a manner, that they form a connected arc or chain, in which each is interposed between the other two.

92. The pile of Volta, by which it is rendered most manifest, is constructed, by combining a series of simple galvanic arcs into one continuous circle, in one uniform order of arrangement.

93. The solid conductors most capable of exciting galvanism, are the metals and charcoal; and the most efficient imperfect conductors are certain saline solutions.

94. The effects of the simple galvanic circle on the animal body, are the production of a sensation of light when applied to the eye; of an acid taste on the tongue; and the excitement of the muscles through the medium of the nerves.

95. The pile, when well constructed, besides these effects, also gives a shock and spark resembling those of electricity, and is the most powerful instrument of analysis with which we are acquainted.

MAGNETISM.

96. If an oblong piece of iron be suspended freely, it will assume a determinate position with regard to the axis of the earth.

97. When the same end always points in the same direction, it is said to possess polarity, or to be a magnet.

98. The similar poles of two magnets repel each other, and the dissimilar poles attract each other, with a force decreasing as the distances increase.

99. Any piece of iron, when in the neighbourhood of a magnet, is a magnet; and its polarity is so disposed, that the magnet and iron mutually attract each other.

100. Magnetism does not seem to affect sensibility or irritability, or to influence chemical action.

OXYGEN.

101. *Oxygen* is the principle on which most of the chemical qualities of atmospheric air depend. Its tendency to combination is so strong, that it has never been procured in a separate

state. Oxygen gas, or the combination of oxygen with caloric, is its most simple form. This is permanently elastic, compressible, transparent, inodorous, and insipid. 100 cubical inches at 60° Fahrenheit, and 30 inches mercurial pressure, weigh about 34 grains. Its specific gravity in relation to water is 0.00135; and in relation to hydrogen, its specific gravity is 15 to 1; its power of refracting light 1958, hydrogen being 1000; and its capacity for heat 4.7, water being assumed as unity. It supports inflammation, is necessary for respiration and vegetation, and is decomposed in all these processes; it constitutes 0.21 of the bulk of atmospheric air. Water at 60° takes up $\frac{1}{27}$ of its bulk of the gas. Oxygen is also a constituent in water, in all acids and metallic oxides, and in almost all animal and vegetable substances. It is separated from many of its combinations by the sun's rays.

102. *Oxygenizement* is an example of chemical union, and is subjected to all the laws of affinity. It requires the presence and contact of oxygen, and of another substance possessing affinity for it.

103. The term *Combustion* has been, by the French chemists, incorrectly extended to all these combinations; for, in common language, that word is applied to cases in which oxygen is not an agent, and always supposes the production of heat and light, although in numberless instances of oxygenizement these phenomena do not appear.

104. Oxygenizable bases attract oxygen with very different degrees of force. This attraction is much influenced by temperature. Thus charcoal, which at ordinary temperatures seems to possess no attraction for oxygen, unites with it rapidly and almost inseparably, when heated to ignition.

105. In many instances, oxygenizement is so strongly opposed by cohesion, that it does not take place unless assisted by a degree of heat sufficient to melt or vaporize the oxygenizable base.

106. It is also often accompanied by the extrication of caloric and light in a very conspicuous degree. To these the term combustion should be confined; and only such oxygenizable bases as are capable of exhibiting these phenomena are combustible. These phenomena depend upon the new compound having a weaker affinity or less capacity than its constituents for light and caloric, which are therefore extricated.

107. If the combustible body be vaporized, flame is produced, and the process is then denominated *inflammation*.

108. By its union with oxygenizable substances, oxygen undergoes various changes in its properties. In many instan-

ces the compounds of oxygen are fluid or solid, opaque, coloured, incapable of supporting inflammation, and deleterious to animal or vegetable life. The changes which the oxygenizable bases undergo, are no less conspicuous. Their form, colour, taste, odour, density, permeability to light and electricity, specific caloric, and, finally, their affinities, are often totally altered.

109. When, in consequence of oxygenizement, any substance acquires a sour taste, and the properties of converting vegetable blues to red, and of saturating or destroying the characteristic properties of alkalies and earths, it is said to be acidified, and such compounds are termed *Acids*. In general, they combine with water, in almost any proportion, without suffering any change in their properties, except what depends on dilution.

110. When, on the contrary, a base by oxygenation acquires a harsh, austere, and urinous taste, and the properties of converting vegetable blues to green, and of saturating or destroying the characteristic properties of acids, it may be said to be alkalized, and the compounds are termed *Earths* or *Alkalies*.

111. Earths, in general, are characterized by total want of inflammability, infusibility, fixedness, a specific gravity less than five, inalterability, whiteness, dryness, brittleness, sparing solubility in water, and, in general, insipidity and want of smell, capability of forming chemical compounds with acids, alkalies, sulphur, phosphorus, and oils, and fusibility when mixed with each other, or with alkalies, into colourless glasses, enamels, or porcelains.

112. Alkalies are a class of bodies which are commonly defined to be incombustible, soluble in water, caustic, and capable of neutralizing the acids, of combining with alcohol, oils, earths, sulphur and phosphorus, and of changing vegetable blues and reds to green: but as many of these properties are possessed in a greater or less degree by substances usually classed with the earths, and as there is a continual gradation from the insipidity, insolubility, and infusibility, of silica, to the causticity, solubility, fusibility, and comparative volatility of potass, they may be both included under the name of Salifiable Bases.

113. When the oxygenized substance does not acquire these properties it is termed an *Oxide;* but many oxides have some of the properties of acids or earths.

114. Many oxides are capable of combining with additional doses of oxygen; those which have only one portion are

called *Protoxides*, with two *Deutoxides*, with three *Tritoxides*, and when fully saturated they get the name of *Peroxides*.

115. Oxygen is capable of combining at the same time with two or more substances; and the oxides or acids which result from such combinations are termed Oxides or Acids with a double or triple base.

116. In general, the bases which are least simple, unite with oxygen in the greatest variety of proportion.

CHLORINE.

117. *Chlorine*, Sir H. Davy, (oxymuriatic acid gas of other chemists,) is of a yellowish-green colour, has an extremely disagreeable smell, 100 cubical inches weigh 76 or 77 grains, its specific gravity to hydrogen being 38.5 to 1; is irrespirable, but supports combustion. It is not changed by heat or cold, or electricity, and when perfectly dry does not act on vegetable colours; but they are quickly destroyed by it when vapour or moisture is present. Water at 60 absorbs about double its volume, weighs 1.003, freezes at 40°, and acquires a strong acrid taste, and disagreeable smell.

Combustibles, by their union with chlorine, have their properties totally altered, and the new compounds are now termed *Chlorides*.

Chlorine combines with oxygen in four proportions.

118. *Protoxide of chlorine (Euchlorine)* was first obtained in a separate state by Sir H. Davy. It is a gas of a bright yellow-green colour, having somewhat the smell of burnt sugar. It is not respirable. 100 inches weigh 74 or 75 grains. Even the heat of the hand causes it to explode, 50 parts expanding to 60, consisting of 40 chlorine and 20 oxygen. Metals do not burn in it, but phosphorus and sulphur decompose it. It gradually destroys vegetable colours. Water takes up eight or ten times its volume, and acquires a lemon colour, and a strongly acrid taste, approaching to sour.

119. *Chlorine*, with additional doses of oxygen, forms also a deutoxide, and two acids, the Chloric and Perchloric.

IODINE.

120. *Iodine* is of a black-grey-colour, and crystallized either in micaceous plates, or broad and brilliant rhomboidal plates, or long octohedrons. Its fracture is lamellated and greasy. It is very friable, and may be reduced to impalpable powder,

It destroys vegetable colours, and stains the skin a deep-orange. Its sp. gr is 4.948. It does not conduct electricity. It melts at 225 F. and boils between 335° and 355°. Its vapour is of a beautiful violet colour, and smells like chlorine, but weaker. Its taste is acrid, hot and durable, and it acts as a poison. Water dissolves a seven millionth part of its weight, and acquires an orange-yellow colour, and when combined with water, it is vaporized along with it at 212°.

Iodine combines with combustible bodies, and these compounds are now called *Iodides*.

121. *Iodic acid* is the name now given to the only compound known of iodine and oxygen, that analogous to chloric acid. It is a white semitransparent solid, without smell, of a strong astringent sour taste. Sp. gr. considerable. Boils about 600 without decomposition. Deliquescent. Very soluble in water, and may be volatilized along with it unchanged. It alters vegetable colours, detonates with inflammables, and corrodes metals.

122. *Chloriodic acid* is the combination of iodine with chlorine. It has a yellow colour, and becomes orange on fusion. It is very volatile, deliquesces, and its solution destroys vegetable colours.

FLUORINE.

123. *Fluorine* has never been obtained in a separate state, and its existence rests upon analogical reasons.

NITROGEN, (AZOTE).

124. *Nitrogen*, or *azotic gas*, constitutes 0.79 parts by bulk of the atmosphere; but as it has few attractions at ordinary temperatures, its principal effect on the chemical properties of the atmosphere seems to be the dilution of the oxygen gas, which in its pure state would be more active than is consistent with the economy of nature. It is permanently elastic, compressible, inodorous, and insipid; it converts very delicate vegetable blues to green; 100 cubic inches weigh between 29 and 30 grains; its specific gravity is 0.0012, water being 1; or 13, hydrogen gas being 1; it is unable to support respiration, vegetation or combustion; it is acidifiable; it dissolves phosphorus and carbon in small quantities, and water absorbs $\frac{1}{77}$ of its volume Its number is 13 or 26.

125. *Atmospheric air* consists of 21 parts of oxygen gas, and of 79 of azotic gas by measure, or 23.47, and 76.53 by

weight; it is transparent, compressible, and permanently elastic; its specific gravity is 0.00123, water being unity; or 13.8, hydrogen being unity; 100 cubic inches weighing 31 grains: it is inodorous and insipid, respirable, and capable of supporting inflammation. The atmosphere also contains other gases, vapour, &c.

126. *Protoxide of azote*, or *nitrous oxide gas* is composed of 15 in weight of oxygen, and 26 of nitrogen, or of equal volumes of their gases. It does not change vegetable colours; 100 cubic inches weigh between 48 and 49 grains; its specific gravity, hydrogen being 1, is 21; it suffers no diminution when mixed with oxygen gas. Water absorbs nine-tenths of its bulk, at a mean temperature. It does not combine directly with alkalies; it supports combustion; and its respiration, when perfectly pure, or mixed with atmospheric air, produces the highest excitement of which the animal frame seems capable.

127. *Deutoxide of azote, nitric oxide gas* (nitrous gas) consists, according to Sir H. Davy, of 26 nitrogen and 30 oxygen, or of one volume of nitrogen and two of oxygen gas. It does not change vegetable colours; 100 inches weigh about 32 grains; its specific gravity to hydrogen is 14. When mixed with half its bulk of oxygen gas, the compound condenses into red fumes (nitrous acid,) which are entirely absorbed by water. The quantity of oxygen gas which any air contains is sometimes estimated by the diminution of volume which occurs, after a due proportion of nitrous gas has been added. Water absorbs about one-twentieth of its bulk of this gas. It is not inflammable, and only in very few instances supports combustion. It is noxious to vegetation, and its respiration is fatal to animals.

128. *Nitrous acid gas* consists, according to Davy, of 2 measures of nitric oxide gas, and one of dry oxygen gas, condensed to half their volume. It has a deep orange colour, disagreeable smell and sour taste. It reddens litmus paper, and gives a yellow colour to animal substances. 100 cubic inches weigh 65.3 grains, and its specific gravity to hydrogen is 28. It is rapidly absorbed by water, which acquires a tint of green, by ether, oil and sulphuric acid. Its compounds are nitrites.

129. *Hydro-Nitrous acid* is of a brown or red colour, exceedingly volatile, and emitting an intolerable and suffocating odour. By the addition of water, its colour is successively changed to blue, green and yellow.

130. *Hydro-Nitric acid* (aqua fortis) consists of nitric acid combined with water. It is liquid, colourless, and trans-

parent. It is very corrosive, and tinges the skin of a yellow colour. When most concentrated, its specific gravity is 1.5543, and it contains 15 *per cent.* water. It produces heat when mixed with water, and absorbs water from the atmosphere. Acid of 1.42 rises unaltered at 248° Fahrenheit. Below 1.4 it strengthens by being boiled, and above 1.45 it becomes weaker. It is decomposed by many substances. Light converts it in part into nitrous acid gas. When highly concentrated, it sets fire to oils, to sulphuretted hydrogen gas, to iron-filings, and to zinc, bismuth and tin, when poured on them in a state of fusion. It oxygenizes all the metals, except gold, platinum, and titanium. It consists of five parts, by bulk, of oxygen, and one of nitrogen, combined in the strongest acid with one, and in that of 1.42 with two of water. Its saline compounds are called nitrates.

131. *Chloride of azote.* Nitrogen forms a very singular compound with chlorine It is obtained by confining chlorine over a saturated solution of nitrate of ammonia, at a very low temperature. The gas is absorbed, and a heavy oil falls, which explodes violently when put in contact with olive oil.

132 *Iodide of azote* is a blackish powder, which detonates with great force spontaneously, when dry, and by a slight pressure under water.

HYDROGEN.

133. *Hydrogen gas* is often found collected in mines and caverns. It is permanently elastic and compressible. 100 cubic inches weigh $2\frac{1}{4}$ grains. Its specific gravity, in relation to water, is 0.000094, being the lightest body with which we are acquainted. It is highly inflammable burning with a blue flame, when kindled in contact with oxygen gas or atmospheric air, and detonating when mixed with them. It extinguishes flame, and is deleterious to animal life. It dissolves sulphur, phosphorus, carbon, and some of the metals, forming with them peculiar fetid gases. In estimating the specific gravity of the gases, being the lightest of them, it is assumed as unity.

134. *Water* consists of hydrogen combined with oxygen, in the proportion of 14.42 to 85.58 by weight, or two of hydrogen to one of oxygen by volume. Water is transparent, colourless, inodorous, and insipid. As water is assumed as the standard, or unity, in all tables of specific gravity of fluids and solids, it is necessary to know that a cubic inch of it weighs, at 30 inches barometer, and 60° thermometer, 252.422 grains. At 32° it exists in a solid form, and is crystallized. At 212° it expands to 2000 times its bulk, and is con-

verted into a very elastic vapour. It absorbs small quantities of the simple gases, especially oxygen. It dissolves several of the salifiable bases, and in some degree all saline bodies, and is essential to their crystallization. It is composed and decomposed in many instances, and its chemical agency is almost universal.

135. *Muriatic* or *Hydro-chloric acid gas* is transparent and colourless. It destroys life, and extinguishes flame. 100 cubic inches weigh between 39 and 40 grains; or its sp. gr. is 0.002315; water being unity; or 17, hydrogen gas being 1. According to Sir H. Davy, it consists of equal volumes of chlorine and hydrogen gas. It decomposes alcohol and oil, and destroys putrid exhalations. Water is capable of absorbing about an equal weight of the gas. Its specific gravity is then 1.500; it is generally of a pale yellow colour, is very volatile, and emits white fumes of a peculiar unpleasant odour. It is further oxygenized by the nitric acid, or, according to Sir H. Davy, de-hydrogenated. *Officinal:* Muriatic acid.

136. *Hydro-iodic acid* is colourless, but has a strong smell and taste. It consists of iodine and hydrogen. It extinguishes combustion, and reddens turnsole. It has a strong affinity for water, forming fumes with that of the atmosphere, and being rapidly absorbed by it. Chlorine decomposes it, becoming muriatic acid, while the iodine is disengaged in violet vapour. Potassium, zinc, and other metals, absorb its iodine, and disengage the hydrogen.

137. *Hydro-fluoric acid* is colourless, does not congeal at —4° Fahr., and boils at a moderate heat, but evaporates very quickly when in contact with the air. Its vapour is very pungent and deleterious. It produces great heat when dropt into water. It acts with great violence on the skin, occasioning great pain and general irritation. It is converted, by its union with a small proportion of silica, into a permanent gas, which till lately was considered to be pure fluoric acid.

138. *Ammonia* consists of 1 part of nitrogen and 3 of hydrogen by bulk, or 3 of hydrogen and 13 of nitrogen by weight. It exists in its purest form combined with caloric as a gas, which is perfectly transparent and colourless, elastic and compressible: specific gravity 8 to hydrogen; or 100 inches weigh 18 grains; has a urinous and acrid odour, irritating the nostrils and eyes, and an acrid and caustic taste; does not dissolve animal substances; is irrespirable; extinguishes flame; colours vegetable blues green; and is decomposed by being transmitted through a red-hot tube, and by the electric spark, into its constituent gases; and by oxygen and atmospheric air at a red heat; and by oxymuriatic acid (chlorine,)

it is converted into water and nitrogen gas. It is absorbed without change by porous bodies; it dissolves sulphur and phosphorus, and combines readily with water in all its states. Water, at a mean temperature and pressure, is saturated by 670 times its volume of gaseous ammonia, is thereby increased in bulk, and acquires the specific gravity of 0.875. Ammonia combines with all the acids, forming neutral salts. It is formed during the putrefactive fermentation, and is commonly classed with the alkalies. *Officinal.*

139. *Iodide of ammonia.* Dry ammoniacal gas is absorbed rapidly by iodine, and with great production of heat. It is a very viscid liquid, of a metallic appearance; by excess of ammonia it loses its lustre, part of its viscidity, and becomes of a very dark red-brown colour. It is not detonating, but becomes so when moistened.

CARBON.

140. *Carbon*, in a state of great purity and extreme aggregation, is well known by the name of *diamond*. It possesses a very high degree of lustre, transparency, hardness, and refractive power. It is crystallized, and generally colourless. Its specific gravity is about 3.5. It is insoluble in water, and can neither be melted nor vaporized by caloric. It is a non-conductor of electricity. It is not acted upon by any chemical agent, except oxygen, at very high temperatures. When exposed in oxygen gas to the rays of the sun, concentrated by a very powerful lens, its surface becomes sensibly blackened; it is ignited, and at last consumed. The result of this combustion is carbonic acid gas, which is exactly equal in volume to the oxygen gas consumed; and 100 parts of it consist, according to Messrs Allen and Pepys, of 28.6 of carbon, and 71.4 of oxygen by weight. It combines with iron, forming steel. It is a constituent of almost all animal and vegetable substances; and is obtained from them by exposing them to heat in close vessels.

141. *Plumbago* and *incombustible coal* are carbon in a state of less aggregation and somewhat impure. In the former, it is combined with about $\frac{1}{11}$ of iron; in the latter with earthy matter. The most remarkable known property of these substances is the very high temperature necessary for their combustion.

142. Common *Charcoal* of wood is another, and the commonest form of carbon. It is obtained in the form of solid masses, of a black colour, and more than twice as heavy as water. It has neither smell nor taste. It is brittle, and ne-

ver crystallized; it rapidly attracts moisture, so as to acquire from 12 to 14 *per cent* of weight. When dry, it also absorbs several times its bulk of any gas in which it is placed. It absorbs light strongly, is refractory in the fire, insoluble in water, and a bad conductor of caloric, but an excellent one of electricity. At a red heat, it burns rapidly in oxygen gas; 28.6 of charcoal, and 71.4 of oxygen, forming 100 of carbonic acid gas. It also burns in atmospheric air, but less vividly. In vacuo, and in gases on which it has no action, it is slowly volatilized by the highest power of galvanism. Common charcoal always furnishes a little water on its combustion, but charcoal from the decomposition of oil gives carbonic acid alone. *Officinal.*

143. *Carbonic oxide gas* is carbon in its first degree of oxidation. It is invisible and elastic; 100 cubic inches weigh about 30 grains, or its specific gravity to hydrogen is 13.2. It does not support combustion or respiration. With oxygen gas it burns with a lambent blue flame, and is converted entirely into carbonic acid, without producing any moisture. It has no affinity for lime. It consists of about 44 carbon and 56 oxygen. When mixed with an equal bulk of chlorine, and exposed to the direct rays of the sun, they unite, are condensed to one-half, and form a peculiar gas discovered by Dr John Davy.

144. *Carbonic acid gas* is transparent, colourless, without smell, irrespirable, and incapable of supporting combustion. 100 cubic inches weigh 47 grains, or its specific gravity to hydrogen is 20.7. Water at 41° absorbs an equal bulk of it, and acquires a specific gravity of 1.0015, an agreeable acidity, and a sparkling appearance, especially if heated to 88°. It is separated from water by freezing or boiling. It is also absorbed by alcohol, volatile and fixed oils. It contains 28.6 carbon, and 71.4 oxygen. Its compounds are called carbonates.

145. *Carburetted hydrogen gas* is the gas evolved in stagnant waters. It has no taste, but a disagreeable empyreumatic smell. 100 cubic inches weigh about 17 grains, and its specific gravity is rather less than 8. It is incapable of supporting respiration or combustion. It burns with a bright yellowish flame, comsuming two parts of oxygen gas. It detonates with two of chlorine by the electric spark, forming four of muriatic acid gas.

146. *Supercarburetted hydrogen* or *Olefiant gas.* 100 cubic inches weigh between 29 and 30 grains, or its specific gravity is 13. It does not support respiration or combustion. It burns with a splendid white flame, and detonates by the electric

spark with great violence, with three volumes of oxygen. With an equal volume of chlorine, it forms a fluid resembling an oil.

147. *Chloride of carbonic oxide* was discovered by Dr John Davy, who called it phosgene gas. It consists of equal volumes of chlorine and carbonic oxide gases; is colourless, has a suffocating smell like chlorine, affects the eyes. It reddens turnsole. 100 cubic inches weigh 111.91 grains. It does not support combustion, and is not decomposed by any of the simple combustibles, but is acted upon by zinc, antimony, arsenic, and other metals, which absorb the chlorine, and disengage the carbonic oxide, while the oxide disengages carbonic acid. It is decomposed by water, and alcohol dissolves twelve times its volume.

148. *Carbo-chloride of ammonia.* The preceding gas unites with four times its bulk of ammoniacal gas, forming a neutral salt, solid, white, volatile, pungent, deliquescent, and very soluble in water, which is decomposed by the sulphuric, nitric, muriatic and phosphoric acids.

149. *Cyanogen* is the name given by Gay-Lussac to a combination of azote with carbon. It is a colourless gas, of a strong disagreeable smell. Sp. gr. 1.8064. It burns with a purplish-blue flame, and is not decomposed by exposure to a red heat. It is absorbed by water and alcohol, and its solutions redden litmus.

150. *Chloric ether* is limpid and colourless, and has the appearance of an oil. Its smell is agreeable, and its taste sharp and sweetish. Its sp. gr. 1.2201, and it boils at 152°. It consists of equal bulks of chlorine and olefiant gas.

BORON.

151. *Boron*, the recently discovered base of boracic acid, is a friable, dark olive, opaque powder, without taste or smell. It is insoluble in water, and a non-conductor of electricity.—An intense heat has no action on it, unless atmospheric air or oxygen be present. But heated strongly in contact with air it burns and forms dry boracic acid. In oxygen it burns with scintillation. It combines with about an equal weight of oxygen. It emits white fumes when gently heated in chlorine.

152. *Boracic acid* crystallizes in small shining flakes, with little taste, and slightly affecting turnsole; sp. gr. 1.479; fixed and vitrifiable in the fire; soluble in 50 parts of boiling water and in alcohol, to which it imparts the property of burning, with a yellow flame.

153 *Chloride of boron* has been lately examined. Boron burns in chlorine gas with a brilliant white flame, and coats the vessel in which it is burnt with a white substance, which by washing yields boracic acid.

154. *Fluo-boric acid gas* is invisible, extinguishes combustion, reddens vegetable blues strongly, is rapidly absorbed by water, and detects, by the formation of dense vapour, hygrometric water in air. It rapidly decomposes animal and vegetable substances. Liquid fluo-boric acid resembles sulphuric acid in causticity and appearance, and in its relations to heat.

SULPHUR.

155. *Sulphur* is a crystallizable solid, of a yellow colour; little sensible taste; peculiar smell when rubbed or heated; specific gravity 1.99; brittle; electric; fusible at 226°; burning with a pale blue flame at 302°; and with a bright white flame at 570°; and capable of combining with different proportions of oxygen. It is found pure in the vicinity of volcanoes, and exists in many minerals, and in animal substances. *Officinal.*

156. *Sulphurous acid gas* is colourless, incapable of maintaining combustion, and deleterious when respired. It has a strong suffocating odour; 100 cubic inches weigh about 68 grains; its specific gravity to hydrogen is 30 to 1. It whitens many animal and vegetable substances. Water at 54° rapidly absorbs 30 times its bulk of this gas, and when saturated, acquires the specific gravity of 1.0513. It is again expelled from the water by heat, but not by freezing. When water is present it is converted by oxygen gas into sulphuric acid. It is decomposed by hydrogen, carbon, and sulphuretted hydrogen gas, when assisted by heat. It oxidizes iron, zinc, and manganese. It consists of equal weights of sulphur and oxygen.

157. *Hydrosulphuric acid* is also composed of sulphur and oxygen. It is a dense liquid; specific gravity 1.85; slightly viscid; transparent and colourless; without smell; of a strong acid taste. It freezes at —36°, and boils at 590°. It has a strong attraction for water, absorbing it rapidly from the atmosphere, and producing considerable heat when mixed with it. It is decomposed by most inflammable substances. It does not oxidize gold, platinum, tungsten, or titanium. It decomposes the alkaline and earthy sulphurets, and reduces all organic substances to charcoal. In medicine it is a powerful refrigerant and antiseptic. It consists of 30 sulphur, 45 oxygen, and 17 of water. What was called Glacial sulphuric

acid, consists, according to Sir H. Davy, of 4 volumes of sulphurous acid gas, and 3 of nitrous acid gas, probably in two or three proportions, with a single proportion of water. *Officinal.*

158. *Chloride of sulphur* was first formed by Dr Thomson. It is a fluid, appearing red by reflected, and yellowish-green by transmited light. Sp. 1.7. It smokes in the air, has the smell of seed-weed, and affects the eyes like peat smoke. It does not redden perfectly dry litmus paper, but is decomposed by water.

159. *Sulphuretted hydrogen gas* consists of one sulphur and two hydrogen; 100 inches weigh 36 or 37 grains, or its specific gravity to hydrogen is 16. It has the odour of rotten eggs; is not respirable; burns with oxygen gas without exploding, and deposites sulphur; an equal volume is absorbed by water, and is the mode in which sulphur exists in mineral waters; reddens vegetable blues; and in its affinities, and the crystallizability of its compounds, it resembles the acids. *Officinal.* Hydrosulphuret of ammonia.

160. *Iodide of sulphur* is formed by exposing them to a gentle heat. It resembles in appearance sulphuret of antimony, and is easily decomposed by heat, the iodine being sublimed.

161. *Sulphur of carbon* is a transparent colourless liquid, of a fetid smell and acrid taste; sp. gr. 1.263. It boils at 115 F., but evaporates rapidly at 60, when in contact with the air producing intense cold. It is exceedingly inflammable.

162. *Sulphurets* are solid opaque bodies, of considerable specific gravity; decomposable by heat, water, and the acids.

- *a.* The alkaline and earthy sulphurets have a red or brownish-red colour, and by solution in water are immediately converted into hydrosulphurets. *Officinal.* Sulphuret of potass.
- *b.* The metallic sulphurets have neither taste nor smell, are often possessed of metallic brilliancy, and are conductors of electricity. *Officinal.* The sulphurets of antimony, of mercury, of iron.

Hydro-sulphurets are soluble in water, and crystallizable, decomposed by the atmosphere and acids.

PHOSPHORUS.

163. *Phosphorus* is a semi-transparent solid, slightly brilliant, and of a waxy consistence; specific gravity 1.79; taste in some degree acrid and disagreeable; smell alliaceous. It

is brittle under 32° : its fracture is vitreous, brilliant, and sometimes lamellated ; above 32° it softens a little, becomes ductile about 90°, melts at 99°, becoming transparent like a white oil ; at 180° begins to be vaporized, and at 554° boils. It is crystallizable into prismatic needles or long octohedrons.

It exists in many minerals, and is obtained from bones and other animal substances. In its solid state, phosphorus is not acted upon by pure oxygen gas; but when melted, burns in it at 80° with a dazzling splendour, absorbing about half its weight of oxygen, and forming phosphoric acid. In atmospheric air it undergoes a slow combustion at 43°, emitting light in the dark, but without the production of sensible heat, absorbing a portion of oxygen, and forming phosphorous acid; at 148° it burns rapidly, but less brilliantly than in oxygen gas, forming phosphoric acid. It is therefore always kept immersed in boiled water; but even there its surface is oxidized, becoming white and opaque.

164. *Oxide of phosphorus*, white flakes which burn when heated, and attract moisture, and are acidified by exposure to air.

165. *Hydro-phosphorous acid* is a white crystalline solid, but water is essential to its composition. It contains four of phosphorous acid and two of water. It is readily soluble in water. The solution has a fetid odour, and disagreeable taste ; and gives out a thick white smoke and vivid flame when strongly heated. It is decomposed by ignited charcoal, and by heating it in contact with ammonia.

166. *Phosphoric acid* is also composed of phosphorus and oxygen. It is crystallizable, fusible, and vitrescent. Its specific gravity is 2.687. It dissolves in water, producing great heat. It readily attracts moisture from the atmosphere, and then its specific gravity becomes 1.417. It is decomposed at a high temperature by hydrogen and carbon, and by several of the metals. It consists of 40 phosphorus and 60 oxygen.

167. Phosphorus burns in chlorine with a pale flame, throwing off sparks, and forms two compounds according to their proportions. *Protochloride of phosphorus* is a fluid as clear as water, to which its sp. gr. is 1.45. It emits acid fumes when exposed to the air. It does not redden dry litmus paper. Its vapour burns in the flame of a candle. It dissolves phosphorus when heated. It is decomposed by water, forming phosphorous and muriatic acids, and by ammonia, depositing a part of its phosphorus. It is converted by chlorine into the perchloride. It consists of one proportion of phosphorus, and two of chlorine.

168. *Perchloride of phosphorus* is a snow white substance, crystallizable, very volatile, but fusible under pressure. It produces flame when exposed to a lighted taper. Its vapour reddens litmus paper. It forms an insoluble compound with ammonia, having characters analogous to an earth. It is decomposed in a red-hot tube by oxygen, and it acts violently on water, forming phosphoric and muriatic acids. It consists of one of phosphorus and four of chlorine.

169. *Phosphuretted hydrogen gas* varies in specific gravity from 4 to 7, hydrogen being 1. It has a disagreeable alliaceous smell It explodes with a most intense white light in oxygen gas. It detonates with a brilliant green light in chlorine. Water absorbs about $\frac{1}{40}$ of its volume; and it is decomposed by electricity, heated metals, &c.

170. *Hydrophosphoric gas*, disagreeable smell, specific gravity 12. to hydrogen. Water absorbs $\frac{1}{8}$ of its volume. It explodes with a white flame in chlorine, one volume absorbing four of the latter. It does not explode spontaneously with oxygen, but detonates violently when heated to 300 Fahrenheit, three volumes absorbing more than five.

171. *Sulphuretted phosphorus* contains various proportions of its elements. It is exceedingly inflammable and more fusible than either of its constituents. 1 of phosphorus and 3 of sulphur congeal at 100 Fahrenheit. 2 of phosphorus and 1.5 of sulphur remain liquid at 40°, and 8 of phosphorus and 1 of sulphur at 68°.

172. Nitrogen gas dissolves phosphorus, forming a fetid gas, which inflames at a low temperature.

173. *Prot-iodide of phosphorus.* Iodine unites with phosphorus in various proportions, disengaging heat but no light. 1 of phosphorus with 4 iodine gives a compound of a red-brown colour, not fusible at a heat considerably above 212°, scarcely acted on by water, but soluble in potass, with disengagement of phosphuretted hydrogen gas; burning at an elevated temperature in the air like phosphorus, and only shewing traces of iodine by the action of chlorine.

174. *Per-iodide of phosphorus.* 1 of phosphorus with 8 of iodine is of a red orange-brown colour, fusible at about 212, and volatilized at a higher temperature. It is decomposed by water, disengaging phosphuretted hydrogen gas, while flakes of phosphorus are precipitated, and the water contains phosphorous acid and hydro-iodic acid. 1 of phosphorus with 16 of iodine is a crystallized substance of a grey-black colour, fusible at 86°, decomposing water without disengagement of phosphuretted hydrogen gas. In whatever propor-

tions phosphorus and iodine are mixed, they exhale, on being moistened, vapours of hydro-iodic gas.

METALS, AND METALLIC OXIDES.

175. Metals are crystallizable; their form depends on the regular tetrahedron or cube; their surface is specular; they are perfectly opaque, even when melted; their colour is various; their lustre peculiar and shining, or splendent; their hardness various, but at least considerable; many of them are brittle, others possess malleability and ductility in a very great degree, and some are scissile, flexile, or elastic; their fracture in general is hackly; their texture compact, fibrous or foliated; many of them are remarkably sonorous; their specific gravity greater than 5, or remarkably light; they possess no smell or taste, unless when heated or rubbed; they are the best conductors of caloric and electricity, are powerful agents in producing the galvanic phenomena, and a few of them are the only substances which exhibit the phenomena of magnetism. By the action of caloric they are melted, but with different degrees of facility, and some of them may be vaporized. Except iron and platinum, they melt suddenly, without undergoing any intermediate state of softness; and when melted, their surface is convex and globular. They are insoluble in water; but some of them decompose it, and are oxidized by it.

176. They are oxidized with different degrees of facility, some by mere exposure to air, and others seem almost to resist the action of heat and air. Their oxidizability is always increased by increase of temperature. Their oxides are in the form of powder, laminæ, or friable fragments; sometimes crystalline; of various colours, determinate with regard to each metal; possess greater absolute weight; are refractory, or fusible into glass; insipid, or acrid and styptic; in general insoluble in water; and combine either with acids and alkalies, or only with one of these. Some of them are disoxygenized by light alone, others by caloric, and others require hydrogen, carbon, &c.

Most of the metals are capable of combining with different proportions of oxygen. Dr Thomson proposes to call the oxides with a minimum of oxygen, Protoxides; and with additional proportions, Deutoxides, Tritoxides, &c. in succession; and the oxides with a maximum of oxygen, Peroxides.

177. Chlorine combines with many of the metals, constituting the substances formerly called *muriates* and metallic butters. With the metal it unites without decomposition, but

when an oxide is exposed to the action of muriatic acid, the hydrogen of the acid and oxygen of the oxide combine to form water, while the metal and chlorine unite. Some metals combine with chlorine in more proportions than one. Sir H. Davy distinguishes them by adding to the name of the metal the termination *ane* when it is combined with a smaller proportion of chlorine, and *ana* or *anea* when with a greater, as phosphorane, phosphorana, stanane, stananea, ferrane, ferranea, &c. but the terms of *Protochloride* and *Perchloride*, used by other chemists, are preferable.

178. Hydrogen gas is capable of holding arsenic, zinc, iron, tellurium, potassium, and boron, in solution; and all these gases contain their own bulk of hydrogen gas.

179. Carbon unites only with iron.

180. The metallic phosphurets are fusible, brilliant, brittle, granulated, lamellated, scarcely combustible, and permanent.

181. The sulphurets are brittle; crystallizable in large brilliant and metallic laminæ, more easily fusible that the refractory metals, but less easily than the very fusible metals; decomposible by heat, humidity, and the acids.

182. The iodides of the easily oxidizable metals, as zinc, iron, tin, antimony, decompose water; those of lead, silver and mercury do not. The iodide of mercury has a fine red colour, or yellowish-green, according as the iodine or mercury predominates. The former melts, and is sublimed in rhomboidal plates of a golden yellow, which on cooling become of a brilliant scarlet.

183. The mixtures of the metals with each other are termed *Alloys:* those in which mercury is contained are *Amalgams.* They acquire by mixture new properties, and are in general more fusible than their components. The reguline metals are not soluble in the acids; but when acted upon by them are first oxidized, and then dissolved. The metallic oxides, by fusion, colour glasses and enamels.

ALKALIZABLE METALS.

The heavier earths, and even the alkalies, have long been supposed by different chemists to be metallic oxides, and were even stated to have been reduced to their metallic form. But their supposition rested only on the vaguest analogies, and their experiments were completely fallacious. The merit of discovering the metallic bases of the earths and alkalies belongs to Sir H. Davy, to whose ingenuity and skill, in applying the powerful agency of galvanism, we are indebted for the most unexpected conclusions ever obtained in experimental chemistry.

184. *Potassium,* the base of potass, is a white metal, brittle and crystallized; in its section resembling polished silver; and at 150° perfectly fluid, very much resembling quicksilver. At a red heat it is converted into vapour. Its specific gravity is between 8 and 9, water being 10. Exposed to the air, it attracts oxygen, and becomes covered with a crust of potass; when gently heated, it burns with an intense heat, and a red light. It explodes and inflames with water, and even with ice. It acts upon all bodies containing water or much oxygene. It burns vividly in chlorine. It is soluble in hydrogen gas, forming a compound which inflames with atmospheric air. It combines with sulphur and phosphorus, and the metals, forming readily oxidizable compounds.

185. *Protoxide of potassium* scarcely known; of a greyish colour, effervesces with water without inflaming.

186. *Potassa,* (Sir H. Davy,) a difficultly fusible substance of a grey colour, vitreous in its fracture, dissolving in water, without effervescence, but with much heat, forming an alkaline solution.

187. *Potass* (hydrat of potassa) is a solid white substance, containing 90 potassa and 17 water, which cannot be separated by heat; extremely acrid to the taste; unctuous to the feel, but highly caustic; destroying the skin, and dissolving all soft animal substances. It is deliquescent, and soluble in half its weight of water at 58° Fahrenheit; it is fusible, and may be vaporized, but is perfectly incombustible; it is capable of crystallizing into very long quadrangular, compressed prisms, terminated by sharp pyramids; it changes vegetable blues to green, and combines with all the acids, oils, sulphur, sulphuretted hydrogen, and the earths. It is obtained from the ashes of vegetables, and exists in some minerals. *Officinal.*

188. *Orange oxide of potassium,* fusible, the result of the slow combustion of potassium in oxygen or air. It supports the combustion of inflammable bodies, supplying the oxygen. It is decomposed by water and carbonic acid, oxygen being evolved.

189. *Chloride of potassium* (muriate of potass.) When muriatic acid and solution of potass are mixed and heated to redness, the hydrogen of the acid and the oxygen of the alkali are set free as water, while the metal and the chlorine combine to form the substance known by the name of muriate of potass. Chlorine also decomposes potassa and the

orange oxide, expelling its oxygen, and potassium attracts chlorine from hydrogen and phosphorus. *Officinal.*

190. *Sodium*, the base of soda, resembles in its appearance silver, has great lustre, and is a conductor of electricity. It fuses at 200° Fahrenheit. It is not volatilized by the heat which melts plate glass. Its specific gravity is 0.9348, water being 1. It absorbs oxygen slowly from the atmosphere, and at a high temperature burns with bright sparks. It decomposes water with effervescence, and is inflamed by nitrous acid.

191. Protoxide of sodium, scarcely known; of a dark grey colour.

192. *Soda*, of a grey colour, and vitreous fracture, a non-conductor of electricity.

193. *Hydrat of soda*, formerly considered as pure soda, contains 22 *per cent.* of water, which cannot be separated by heat, of a greyish white colour, urinous taste, and burning causticity, acting with considerable violence on animal matter. Water, in a certain proportion, when thrown upon it, is absorbed and solidified, with the disengagement of caloric, and a lixivial smell. A larger quantity dissolves it. From the atmosphere it absorbs moisture and carbonic acid, becoming less caustic. In the fire it melts like an oily substance; boils, and is converted into vapour, but is incombustible. It is crystallizable into transparent prismatic crystals. It changes vegetable blues to green; unites with all the acids, oils, sulphur, sulphuretted hydrogen, phosphorus, many metallic oxides, and the earths. It forms the basis of rock-salt, and sea-salt; is obtained from the ashes of marine plants, and exists in some minerals.

194. *Chloride of sodium* (muriate of soda) consists of one proportion of sodium and two of chlorine. It is a non conductor of electricity. It fuses in a strong red heat, and volatilizes in a white heat. It crystallizes in cubes. It is decomposed by potassium, which attracts its chlorine.

195. Sodium readily forms sulphurets and phosphurets which are less inflammable than those of potassium.

196. Potassium and sodium combine readily in various proportions. A small quantity of potassium renders sodium brittle and very soft. A small quantity of sodium renders potassium fluid at a common temperature, and reduces its specific gravity considerably.

197. *Barium*, the base of barytes, a dark grey-coloured solid; lustre less than cast-iron, heavier than sulphuric acid, decomposes water, and is oxygenized by exposure to the air.

198. *Barytes* is obtained in small, grey, porous masses of tolerable solidity; its taste is acrid, urinous and pungent; applied to the skin, it proves caustic, and it is deleterious when swallowed; its specific gravity is 4; it is soluble in twenty times its weight of cold water, and in twice its weight of boiling water; depositing, on cooling, transparent, white, prismatic crystals; when slaked, it boils up with violence, becomes very hot, increases in bulk, and is changed into a spongy white mass. It changes vegetable blues to green; it is fusible; and combines with all the acids, sulphur, sulphuretted hydrogen, and phosphorus. It is the basis of some of the heavy spars.

199. *Strontites* is obtained in small, whitish-grey, and often porous masses; its taste is warm, acrid, and urinous; it is slightly caustic, acting feebly on animal matters. Taken into the stomach, it is not poisonous; its specific gravity is nearly 4; it is soluble in 200 times its weight of water at 50°, but in little more than six times its weight of boiling water, which, on cooling, deposites flat rhomboidal crystals; it is slaked more rapidly than lime, and it is infusible; it changes vegetable blues to green; it combines with all the acids, sulphur, sulphuretted hydrogen, and phosphorus, alumina, and silex. It is the basis of some of the heavy spars.

200. *Calcium*, the base of lime, is brighter and whiter than barium or strontium.

201. Lime is of a grey-white colour, warm, acrid and urinous to the taste; sp. gr. 2.33, soluble in 450 times its weight of water. It is apyrous; it changes vegetable blues to green; it combines with all the acids, sulphur, sulphuretted hydrogen, and phosphorus; it is very abundant in the mineral kingdom, and forms the basis of animal bones and shells. The calcareous spars, marble, limestone, chalk and marl, consist chiefly of lime. *Officinal.*

202. Hydrat of lime. When a small quantity of water is thrown upon fresh burnt lime, it is absorbed rapidly, with the extrication of considerable heat, and some phosphorescent light; at the same time the lime crumbles down into a very fine, white, dry powder, augmented much in bulk, but less caustic than before. Lime, thus slaked, does not renew these phenomena, on a farther addition of water, but may be diffused or dissolved in it.

203. *Phosphuret of lime* is insoluble in water, but they decompose each other, producing phosphuretted hydrogen gas, which arises in bubbles to the surface of the water, where they explode with a clear flame. Phosphuret of baryta is a brown mass; of a metallic appearance; very fusible; luminous in

the dark; decomposed by exposure to air; emitting an alliaceous smell when moistened; and decomposed by water, furnishing phosphuretted hydrogen gas. The phosphuret of strontia is very similar.

204. *Magnesium*, the base of magnesia, only obtained as a dark grey metallic film; less fusible than plate glass, burning with a red light when strongly heated, and decomposing water slowly.

205. *Magnesia* is obtained in light, white, friable masses, or very fine powder; to the touch it is very fine; its taste is not very sensible, but peculiar and pleasant; its specific gravity is 2.33. It is insoluble in water, but forms with it a paste without ductility. It is apyrous; slightly alters vegetable blues to green; forms soluble compounds with most acids, and unites with sulphur. The fossils in which it predominates are generally soft, and have an unctuous feel. The principal are talc, steatites, asbestos, &c.

206. Hydrat of magnesia is the state in which it is obtained by precipitation, from its solution in an acid, by potass or soda.

207. *Alumina* is obtained in friable fragments, or in a very fine white powder; soft and unctuous to the touch; adhering strongly to the tongue, absorbing its moisture, and producing a slightly styptic effect upon it; specific gravity 2; insoluble in water, but very diffusible through it; absorbing a certain quantity of it rapidly, and forming with it a very ductile adhesive paste, which contracts and hardens remarkably in the fire, but is perfectly infusible. Its ultimate particles seem to be opaque. It combines with most of the acids, and these compounds have a sweetish styptic taste; it unites with charcoal, the alkalies, baryta, strontia, lime and silica; it is manufactured into porcelain and glass. Fossils, containing much alumina, have generally a laminated structure; it exists crystallized in sapphire; and it forms the basis of all clays, boles, mica, trap, basalts, slate, and corundum.

208. Glucinum; scarcely known.

209. *Glucina* is obtained in white light masses or powder, of a soft feel, insipid, but adhering strongly to the tongue; apyrous; and soluble in water, but forming with it a paste, slightly ductile and adhesive; it is soluble in potass, soda, and carbonate of ammonia; it combines with most of the acids, forming soluble salts, difficultly crystallizable, of a sweet and somewhat astringent taste, and with sulphuretted hydrogen. It has hitherto been found very sparingly only in the beryl and emerald.

210. *Thorinum*, Never examined.

211. *Thorina*, white, soluble in muriatic acid; neutral salts astringent.

212. *Zirconum*, the basis of zircona; properties little known.

213. *Zircona* is obtained in the form of a harsh whitish powder; without taste or smell; having a specific gravity of 4.3; insoluble in water; softened by the heat of a smith's forge; but when surrounded by charcoal, its particles become agglutinated, and so hard as to strike fire with steel; soluble in all the acids; fusible with silex and alumina; insoluble in the alkalies, but soluble in their carbonates. It is only found in the zircon or jargon of Ceylon, and in different varieties of hyacinth.

214. *Hydrat of zircona* has the appearance of a resin or glue. It contains more than 20 *per cent.* water, which may be expelled by heat.

215. *Silicum*, the basis of silica; properties not ascertained.

216. *Silica*, when obtained perfectly pure by art, is in the form of a very fine white powder, hard, rough, and gritty, to the touch; when applied to the tongue, giving a rough and dry sensation, but without taste or smell, having a specific gravity of 2.66; in the state of hydrat, soluble in 1000 times its weight of water; soluble in the fixed alkalies and fluoric acid; fusible with the fixed alkalies and other earths; and combining, by fusion, with the metallic oxides, and the phosphoric and boracic acids. It has a tendency to crystallization, and its ultimate particles seem to be transparent. It in general imparts to the fossils, of which it is a principal constituent, transparency, lustre, a tendency to crystallization, and a degree of hardness, enabling them to strike fire with steel. Rock crystal, quartz, agate, flint, chalcedony, jasper, shorl, are examples of siliceous stones.

217. *Ittrium*, the basis of ittria, not ascertained.

218. *Ittria* is obtained in the form of a fine white powder, without taste or smell; insoluble in water; it does not alter vegetable blues; is infusible; insoluble in the alkalies, but readily soluble in the carbonate of ammonia. With the acids it forms salts, which have a sweet and somewhat austere taste. It has been found only in the Gadolinite.

OXIDIZABLE METALS.

219. *Manganesum.* Small whitish grey globules; specific gravity 6.850; very hard and very brittle; very difficult of fusion; very oxidizable by exposure to air; decomposes water rapidly; is oxidized by the sulphuric and nitric acids;

burns when strongly heated in oxygen or chlorine; combines with many metals. According to Berzelius, it forms five oxides, containing 1, 2, 4, 6, and 8 proportions of oxygen, to one of metal. These oxides colour glass brown, violet, or red, and destroy the colour of glass coloured by iron.

220. *Zinc* is bluish-white, lamellated, sapid, and odorous; specific gravity 7.190; soft, clogging the file; above 212° malleable and ductile; fusible at 700°; vaporizable; a powerful agent in the phenomena of galvanism; oxidized by fusion; at a red heat it catches fire, and emits white films of oxide; it easily decomposes water; it is oxidized and dissolved by almost all the acids. *Officinal.*

221. *Tin* is pure brilliant-white, sapid and odorous; specific gravity 7.291 to 7.500; soft, flexible, and emitting a crackling noise when bent; very malleable; fusing at 442° Fahrenheit; oxidizes slowly in the air; is converted, when fused, into a grey oxide; when red hot it burns vividly. Sulphuret and phosphuret are lamellated and brittle; it forms alloys with arsenic, bismuth, antimony, mercury, and zinc; it is oxidized by many acids, and combines with the fluoric, boracic, and carbonic acids. *Officinal.*

222. *Iron* is of a bluish grey colour; texture either fine grained, fibrous, or dense plates; sapid and odorous; specific gravity 7.600; the hardest, most elastic, and most tenacious metal; very ductile; fusing at 158° Wedgwood, fusion at first clammy, afterwards very fluid; igniting by strong percussion, and inflaming by the collision of flint; magnetic. It is oxidized slowly in the air, especially when moist; when heated in contact with air, it is oxidized; deutoxide, black, fusible, hard, brittle, lamellated, still attracted by the magnet; tritoxide, fine, pulverulent, not attracted by the magnet, containing 0.40 to 0.49 of oxygen. It burns with splendour and deflagration in oxygen gas, and is converted into a fused black oxide; it decomposes water slowly, and when ignited, very rapidly. Iron is oxidized and dissolved by almost all the acids. It gives glasses a brown, smoky, deep green, or black colour. Carbon united to iron converts it into steel. *Officinal.*

223. *Steel* is of a grey colour, brilliant and granular in its fracture; specific gravity 7.795; harder than any of the metals, and more elastic, ductile, malleable, and fusible at a lower temperature than pure iron. Its characteristic property is, that after being heated, if suddenly plunged into cold water, it becomes harder, more elastic, less pliable, and brittle; but by being again heated and cooled slowly, it acquires its former softness, pliability, and ductility. Steel contains only

some hundredth parts of carbon, and is known chemically by letting a drop of acid fall upon it, which produces a grey or black spot. *Plumbago* consists of about 0.1 of iron, combined with carbon.

224. *Lead* is of a grey blue livid colour, streak grey, disagreeable taste and odour; specific gravity 11.352; soft; very laminable; hardens little under the hammer; very flexible; not very ductile; slightly tenacious; fusible at 612° Fahrenheit; volatile at a red heat; tarnished in the air; slightly oxidized by air and water; burns when strongly ignited, and in oxygen with a brilliant white flame. When heated in chlorine it unites with it, but it does not inflame. Its phosphuret and sulphuret are brittle; and it is oxidized by, and combines with, the sulphuric, nitric, phosphoric, and other acids. Its oxide imparts to glass a uniform density, and strong refracting power. *Officinal.*

225. *Antimony.* White, very brilliant, lamellated; specific gravity 6.702; moderately hard; pulverizable; fusible at 809; volatile when highly ignited; sensible taste and smell; unalterable in cold air; oxidizable by air and heat; oxide fusible into a yellow-brown glass; decomposes water when ignited; oxidized by the sulphuric and nitric acids; combines with phosphorus and sulphur. Oxides colour glass yellow and hyacinthine. *Officinal.*

226. *Bismuth.* White, slightly yellow, in large specular plates; pulverizable; specific gravity 9.822; moderately hard; sensible odour and taste, fusible at 460°, and volatile at a high temperature; oxidizable by heat and air; oxide vitrifiable into a greenish-yellow glass; oxidizable by boiling sulphuric, nitric, and muriatic acids; unites with sulphur. Oxide yellow, and colours glass of a greenish-yellow.

227. *Tellurium.* White, lead-grey, very bright, harsh and brittle; lamellated; crystallizable; specific gravity 6.115; very fusible and volatile; burns with a blue and greenish flame, and a white smoke, having the odour of radishes; oxide very fusible into a straw-coloured radiated glass; soluble in sulphuric, nitric, and nitro-muriatic acids; unites with sulphur. Oxides black, white.

228. *Cobalt.* Reddish-grey, fine grained, pulverizable; specific gravity between 7.770 and 7.800; very difficult of fusion; oxidizable before fusion; unalterable by water; acted on by all the acids; combines with phosphorus and sulphur; its alloys are granulated, rigid, and brittle. Oxides deep blue and black, and colour glasses of a fine blue.

229. *Copper.* Bright red; disagreeable taste and smell when rubbed or heated; specific gravity 7.79; ductile; of

great tenacity; sonorous; fusible at 27° Wedgwood; granulated texture, and subject to blisters; a good conductor of caloric, electricity, and galvanism; becomes brown, and at last green in the air; when heated turns blue, yellow, violet, deep brown; when ignited and plunged into water, forms brown, brittle scales of oxide. Its phosphuret is brilliant, brittle, hard, and fusible; its sulphuret brown, fusible, and very phosphoric; its alloy with arsenic is white, with bismuth reddish, with antimony violet, with mercury deep red, with zinc forms brass, and with tin is orange; it is oxidized and dissolved by the sulphuric, nitric, and muriatic acids; its oxide is brown, brittle, and soluble in ammonia, acquiring a beautiful blue colour. *Officinal.*

230. *Nickel.* Colour between those of platinum and steel; undergoing changes of colour by the action of fire similar to those of steel; specific gravity nearly 9; malleable and ductile; magnetic; very difficult of fusion, and of oxidization in the air; oxidizable by most of the acids, which it colours of a brilliant green; combines with phosphorus, sulphur, and the metals. Oxide grey, colouring glass brown, orange, red.

231. *Uranium.* An incoherent mass of small agglutinated globules, of a deep grey and pale brown; specific gravity 8.1; very hard; very difficult of fusion, even by long continued heat; is acted upon by several of the acids; combines with phosphorus. Oxides soluble in the alkalies, and very soluble in their carbonates. Oxides black, yellow, colouring glass of a greenish-yellow, emerald green, or brown.

232. *Osmium.* Dark grey or blue; infusible when excluded from the air; insoluble in all acids; oxide forms a yellow solution with potash, and is extremely volatile, smelling like oxymuriatic acid.

233. *Titanium.* Agglutinated, hard, friable masses, crystallized internally of a brilliant red; infusible; unalterable by water; oxidizable by boiling sulphuric, nitric, and muriatic acids. Oxides blue, deep red, white.

234. *Cerium.* Oxides white and brown; the former most readily soluble in nitric, and the latter in muriatic and sulphuric acids.

235. *Palladium.* Dull white, malleable, ductile, fusible, specific gravity 11.5; hard; forms a red solution with nitro-muriatic acid; affording an orange precipitate with alkalies and earths; and olive-coloured with prussiate of potass.

236. *Iridium.* White; very heavy; infusible; insoluble in acids, unless when previously combined with an alkali; muriatic and sulphuric solutions, green and blue; nitric, red.

The former give a green precipitate, soluble in excess of alkali: the latter a red, insoluble.

237. *Rhodium.* White, infusible; specific gravity 11; unites with other metals readily, except mercury. Soluble in all acids. Muriate of rhodium rose-coloured; soluble in alcohol; not precipitated by prussiate of potass, muriate, or hydrosulphuret, or alkaline carbonates of ammonia; but by alkalies in the form of a yellow oxide.

238. *Mercury.* Very bright white; specific gravity 13.568; freezing at —39°; boiling at 660°; when frozen, ductile and malleable; oxidizable by trituration in the air, and in a farther degree by the action of the air and heat; does not decompose water; forms amalgams with many metals; and is oxidized and dissolved by the sulphuric, nitric and oxymuriatic acids. Oxides black, red. *Officinal.*

239. *Silver.* Very brilliant white, insipid, inodorous; specific gravity 10.474 to 11.091; hardness between iron and gold; elasticity between gold and copper; strong acute sound; considerable ductility and tenacity; hardening much under the hammer; a good conductor of electricity, caloric, and galvanism; fusible at 28° Wedgwood; crystallizable by cooling; unalterable in the air; changed into a greenish oxide by long and violent heat, burning with a greenish flame; and instantly by the electric shock. Its phosphuret is granulated, brittle, and fusible; its sulphuret grey, black, lamellated, or striated, and fusible; it unites but slightly with the acidifiable metals and iron; is hardened by gold, bismuth, antimony, tin, lead, and copper, and amalgamates with mercury. It is oxidized and dissolved by the sulphuric, sulphurous, and nitric acids, and combines with chlorine. Its oxide is olive; reducible by the other metals, hydrogen, and light and heat; colours some glasses of an olive green, and is very soluble in ammonia. *Officinal.*

240. *Gold* is of a brilliant yellow colour, insipid, and inodorous; specific gravity between 19.258 and 19.300; soft and flexible; little elasticity or sonorousness; so ductile, that its surface may be extended more than 650,000 times; of very great tenacity; easily hammer hardened; a good conductor of caloric, electricity, and galvanism; fusing at 32° of Wedgwood; brittle when cooled too quickly; crystallizing in octohedrons; unalterable in the air; converted by a long and violent heat into a vitrified violet oxide; oxidized and dispersed by electricity; soluble in alkaline sulphurets; rendered brittle by phosphorus, arsenic, bismuth, tin, and antimony; less brittle by lead; soluble in mercury; hardened by zinc, copper, iron, steel, and silver; oxidizable, of a purple colour, and

slightly soluble in nitrous acid; readily oxidized and dissolved by nitro-muriatic acid. Its oxide is easily reduced by light and heat, colours glasses purple or topaz yellow, and forms a fulminating compound with ammonia.

241. *Platinum.* Of a grey white colour, almost black when polished, insipid, inodorous; specific gravity 20.850 to 21.061; softer only than iron, and less ductile only than gold; most difficult of fusion, above 160° of Wedgwood; a good conductor of electricity and galvanism; unalterable by air and heat; converted into a grey powder, its first degree of oxidation, by electricity; unites with phosphorus; forms alloys with arsenic, bismuth, antimony, mercury, zinc, tin, lead, cast iron, copper, silver and gold. It is oxidized and dissolved by the oxymuriatic acid, and more readily by the nitromuriatic. Oxide grey.

ACIDIFIABLE METALS.

242. *Tungsten.* Small slightly adherent globules of a slate grey; specific gravity 17.5; very infusible; oxidizable in the air by heat, and afterwards acidifiable. Oxide yellow, pulverulent, colouring glass of a blue or brown colour; and a white harsh powder; specific gravity 6.12.

243. *Columbium* or *Tantalium* has hitherto been examined only in the state of oxide or acid, which is a white powder insoluble in water, nearly insoluble in sulphuric, nitric, or muriatic acids, but soluble in citric, tartaric, and oxalic acid; soluble in water when fused with potass or soda; solution not precipitated by prussiate or hydrosulphuret of potass, but precipitated orange by infusion of galls.

244. *Arsenic.* Grey plates of a lively brightness; friable specific gravity between 8.310 and 5.073; vaporizable at 540°; emitting a smell like garlic; crystallizable; oxidizable in the cold air; inflammable at a red heat, and sublimed in the form of the white oxide or acid; farther oxidizable by the nitric and nitrous acids; combines with phosphorus, sulphur, and many of the metals; soluble in hydrogen gas. *Officinal.*

245. *Molybdenum.* In black powder, or agglutinated, blackish, friable masses, having little metallic brilliancy; specific gravity 8.611; by a strong heat changes into a white brilliant oxide in needles, and very acidifiable: oxidizable by boiling sulphuric acid, and acidifiable by the nitric acid. It forms a sulphuret; and its alloys are granulated and friable; acid white, pulverulent, styptic; specific gravity 8.400.

246. *Chromum.* Agglutinated masses of a whitish-grey colour; very hard, very brittle, and very infusible; appears to

be difficult to oxidize, and easy to disoxidize; does not appear to decompose water; not attacked by the sulphuric or muriatic acids; changed into a green oxide, and afterwards into a red acid, by the nitric acid distilled from it. Oxide of a beautiful emerald green; acid red, and, combined with lead, rich orange-yellow.

COMPOUND OXIDES, ACIDS AND ALKALIES.

247. We have already noticed all the binary combinations which oxygenizable substances form with oxygen. These in general have considerable permanence in their characters, and admit of few variations in the proportions of their constituent principles. But oxygen is capable of entering into combination at the same time with more than one simple substance, forming oxides and acids with double or triple bases, which, in consequence of the increased number of principles, are subject to greater variations in their proportions, and are less permanent in their characters. These are, however, the substances with which pharmacy is chiefly occupied, as they comprehend almost the whole of the vegetable and animal kingdoms. Chemists, borrowing their arrangement from natural history, have almost always considered them under the title of Vegetable and of Animal Substances. But such an arrangement is so totally unconnected with the principles of chemistry, that the imperfect state of our knowledge is the only apology that can be offered for its continuance; and limited as that knowledge is, we are persuaded that an attempt at a classification of these bodies, on chemical principles, is to be preferred.

COMPOUND OXIDES.

248. The compound oxides are characterized by their great alterability, and by their affording, when burnt with a sufficient quantity of oxygen, both water and carbonic acid. They may be divided into

a. Ternary oxides, containing various proportions of carbon, hydrogen, and oxygen;

b. Quaternary oxides, consisting of nitrogen, carbon, hydrogen, and oxygen.

249. The ternary oxides coincide nearly with the class of vegetable substances; and are characterized,

a. By their being converted entirely into water and carbonic acid gas, when completely decomposed by oxygen;

b. By their undergoing the acid fermentation, from the action of air and water;

c. And by their furnishing nitrous gas and carbonic acid, when treated with nitric acid.

250. The quaternary oxides coincide nearly with animal substances, and are characterized.

a. By their furnishing, when decomposed by oxygen, ammonia as well as water and carbonic acid gas;

b. By their becoming putrid from the action of air and water;

c. By their furnishing nitrogen gas when treated with nitric acid.

d. And by their furnishing ammonia when triturated with potass.

TERNARY OXIDES.

251. *Alcohol* is a transparent colourless liquid, of an agreeable penetrating smell, and pungent burning taste: specific gravity 0.8. It remains fluid in the greatest natural or artificial cold. It boils at 176°, and in vacuum at 56°. Alcohol unites with water in every proportion. During the combination, caloric is evolved, and the specific gravity of the compound is greater than the mean of those of the components. Alcohol dissolves about 60 of sulphur, when they are presented to each other in a state of vapour. It also dissolves a little phosphorous. These solutions are decomposed by water. It dissolves the boracic and carbonic acids, ammonia, soda, and potass, and is the means employed to obtain the two last in a state of purity. Its action on the salts is various. It dissolves the volatile oils, resins, soaps, balsams, camphor, sugar, tannin, cinchonin, extractive, and in part the gummy resins. Alcohol is very inflammable, and when kindled burns entirely away, with a blue flame without smoke. The products of its combustion are carbonic acid and water. It is also decomposed by being transmitted in the state of vapour through a red-hot porcelain tube; by being heated with the fixed alkalies; and by the action of the sulphuric, nitric, and acetic acids, and of chlorine. *Officinal.*

252. *Sulphuric ether* is a transparent colourless fluid, of a very fragrant odour, and hot pungent taste: specific gravity 0.758. It freezes and crystallizes at —46°. It boils at 98°, and in vacuum at —20°. It is very soluble in air, and during its evaporation it produces an intense degree of cold. It is soluble in ten parts of water, and in alcohol in every proportion. It dissolves a small portion of phosphorus, and the solution is

decomposed by alcohol. It absorbs nitrous gas, combines with ammonia, and dissolves the volatile oils, resins, and caoutchouc. Ether is extremely inflammable, and burns with a white flame. Its vapour explodes when kindled in contact with oxygen gas. It is decomposed by sulphuric acid, chlorine, and by being transmitted through a red-hot porcelain tube. Its constituents are oxygen, carbon, and hydrogen; the proportions not ascertained. *Officinal.*

253. An ether perfectly similar to the sulphuric may be prepared by means of the phosphoric or arsenic acids. Into the composition of these ethers, none of the acid enters.

254. *Muriatic ether, nitrous ether, and hydriodic ether*, agree in being more volatile than alcohol, but each of them derives peculiar properties from the acid which enters into their composition as an essential constituent.

255. *Acetic ether, benzoic ether, oxalic ether, nitric ether, malic ether, and tartaric ether*, agree in being less volatile than alcohol, and differ like the preceding from the presence of their respective acids.

256. *Pyroacetic spirit* is procured in greatest purity by distilling acetate of barytes. It is a white, limpid fluid, taste at first acrid, afterwards cooling, smell resembling a mixture of peppermint and bitter almonds: specific gravity 0.7864, inflammable, boils at 165°. It mixes readily with water, alcohol and volatile oil, and hot olive oil. It dissolves camphor, and, when hot, wax and tallow, and a little sulphur and phosphorus. It dissolves potass, becoming darker coloured. It is changed by sulphuric acid, and is decomposed by nitric. It enters into combination with muriatic acid, forming with it a peculiar compound. It is contained in vinegar.

257. *Fixed Oils* are transparent, more or less coloured, somewhat viscid, inodorous fluids, having a mild taste and unctuous feel. In the different species the specific gravity varies from 0.9403 to 0.9153. The point of congelation also differs considerably, but in general it is within the range of the ordinary temperatures of the atmosphere. Their boiling point exceeds 600°; and by being converted into vapour, they become empyreumatic. Fixed oils do not seem capable of combining with charcoal, but are freed from impurities by being filtered through hot charcoal. When assisted by heat, they dissolve sulphur and phosphorus. They may be blended with sugar and gum by trituration, as in emulsions, and they dissolve the volatile oils, resins, and gummy resins. With the alkalies and earths they form soaps, and with metallic oxides plasters. They are not soluble in water, but have various habitudes in regard to alcohol. They unite readily with

oxygen, which renders them concrescible. Those oils which dry without losing their transparency, as linseed oil, are termed drying oils, in contradistinction to the fat oils, which from exposure become white, opaque and thick, and remain greasy, such as oil of olives or of almonds. When they become rancid, they undergo a further degree of decomposition, and are found to contain sebacic acid. Oil in the state of vapour is inflammable, and burns with a white flame. When the combustion is complete, the products are carbonic acid gas and water, but in general soot is also deposited. The sulphuric acid renders the fixed oils brown and thick, and converts them into water and charcoal. The nitric acid oxygenizes them. The oxygenized muriatic acid or chlorine blanches them, and renders them concrete, like tallow or wax. The oils oxidize several of the metals, and are oxidized by several of their oxides. *Officinal:* Oil of almonds, linseed, mustard, castor oil, and cocoa butter.

258. *Animal fats* possess many properties in common with the fixed oils, and differ chiefly in their being congealed and opaque at the temperature of the atmosphere. They differ considerably in fluidity, from the semifluid ducks' grease to the solid mutton suet. All these fats as well as the fixed oils have been lately ascertained by M. Chevrueil and Bracconot to consist of two substances, Stearin and Elain, combined in different proportions.

259. *Stearin* is crystallizable, white and brittle, with little smell or taste. It melts at from 109° to 120°, is soluble in alcohol. It is altered by the action of alkalies, and forms with them soap.

260. *Elain* is the fluid constituent of oil and fat, remaining liquid at 59°. It is seldom pure or free from colour and taste.

261. *Wax* is a solid of considerable consistence, granulated and crystalline in its fracture, of a white colour, and without any remarkable odour or taste. It softens and becomes plastic when very slightly heated; at 142° it melts; at a higher temperature it is in part vaporized and decomposed, and its vapour is inflammable. It resists in a remarkable degree the action of the acids; but in most of its other properties it resembles the fixed oils. *Officinal.*

262. *Spermaceti* may be obtained crystallized in white argentine plates, of an unctuous feel and taste, and a vapid smell. It melts between 90° and 95°, and at a higher temperature may be sublimed almost unchanged. Its vapour is inflammable, and its flame is bright, clear, and without smell. By exposure to the air it becomes rancid. It is soluble, es-

pecially by the assistance of heat, in alcohol and in ether. In its other properties it agrees with the fixed oils, with which it unites very readily by fusion. Muscular flesh, by long maceration in water, is converted into a substance very analogous to spermaceti, but more fusible, melting at 82°; and biliary calculi often consist of another, which is much less fusible, requiring a heat of 192° for its fusion. For all these varieties, Fourcroy has proposed the generic name *Adipocire*. *Officinal:* Spermaceti.

263. *Soaps* are combinations of the fluid or concrete fixed oils with alkalies, earths, or metallic oxides. The alkaline soaps have an unpleasant taste and peculiar smell, form a milky solution with water, and a transparent one with alcohol, and are powerfully detergent. White soap is made of soda and olive oil or tallow. Brown soap contains also resin. Soft soap consists of potass and whale oil: the white spots in it are from the addition of a little tallow. The volatile liniment of the pharmacopœias is a soap of ammonia and olive oil. The alkaline soaps are decomposed by all the earthy salts. The alkali of the soap combines with the acid of the salts, and an earthy soap is formed from the union of the earth and oil. The earthy soaps are insoluble in water. The alkaline soaps are decomposed in the same way by the metallic salts. The metallic soaps are also insoluble in water; many of them are soluble in oil, and some of them in alcohol. *Officinal:* Soaps of soda and ammonia.

264. *Plasters* are also combinations of oil with metallic oxides. They are prepared by their immediate action on each other. Olive oil and litharge are most commonly employed. *Officinal:* Litharge plaster.

265. *Volatile oils* differ from the fixed oils most remarkably in being vaporized unchanged by heat under 212°; by evaporating completely, without leaving a stain on paper; by being sapid, often pungent and odorous; and by being soluble in alcohol, and to a certain degree in water. They are more inflammable than the fixed oils, and burn with a large white flame, emit a great deal of smoke, and require more oxygen for their combustion. By exposure to the air they become coloured and thick, and are at last converted into an almost inodorous resin. They are also oxidized and converted into resins by muriate of mercury and muriate of antimony; the acids act on them with great violence, and are even capable of inflaming them. On the other hand, they resist considerably the action of the alkalies. In their other general properties they agree with the fixed oils, from which they seem to differ in composition, only in containing a larger proportion

of hydrogen. In other respects, these oils are infinitely varied, especially in their taste and odour. Some are as limpid as water, others are viscid, others congeal on a slight diminution of temperature, and are even naturally concrete, and others are capable of forming crystallizations. Their predominant colours are the different shades of yellow and red, but there are also blue, green and glaucous essential oils. Their specific gravity varies from 0.8697 to 1.0439. *Officinal:* Oil of anise, cajeput, caraway, fennel, juniper, lavender, mace, origanum, pennyroyal, peppermint, pimento, rosemary, rue, sassafras, savine, spearmint, turpentine, cloves, and all aromatic or odorous substances. *Empyreumatic oils:* Oil of amber, of hartshorn, of petroleum.

266. *Resins* are concrete substances, possessing a certain degree of transparency, and generally of an amber or brownish red colour. Their texture is homogeneous, and their fracture vitreous. They are easily reduced to powder, which readily agglutinates. Their specific gravity varies from 1.0452 to 1.2289. They have little taste or smell. They are electrics. Exposed to a certain degree of heat, they melt without suffering alteration, but they are decomposed when converted into vapour. Their vapour is inflammable, and burns with a large strong flame and a great deal of soot. Resins unite by fusion with sulphur, difficultly with phosphorus. They are soluble in alcohol, the fixed and the volatile oils, and alkalies, and in nitric acid with evolution of nitric oxide gas. They are insoluble in water, and are not acted upon by metallic oxides. *Officinal:* Pine resin, dragon's blood, balsams of Peru, Tolu, Gilead and Canada, turpentine, benzoin, storax, olibanum, tacamahac, mastiche, sandarac, elemi.

267. *Guaiac* differs from the resins in being soluble in nitric acid without the assistance of heat, and forming oxalic acid instead of tannin; in nitric and oxymuriatic acid, changing the colour of its solutions to green, blue, and brown, successively, and in affording a larger quantity of charcoal. *Off.*

268. *Lac* differs from resin in not being soluble in alcohol without the aid of a boiling temperature, and in being precipitated from it as it cools. Vauquelin analyzed a gum resin from Madagascar, which contained both resin and lac in the proportions of 84 to 6.

269. *Amber, copal,* and about one-fifth of *sandarac,* differ from the resins in not being soluble in alcohol without peculiar management.

270. *Camphor* is a concrete friable substance, of a white colour, with a considerable degree of transparency, and a crystalline appearance, specific gravity 0.9887. Its taste is bit-

ter and acrid, and its smell penetrating and peculiar. It is evaporated unchanged by a heat of 145°, but may be melted by suddenly exposing it to 302°. The vapour when condensed crystallizes in hexagonal plates. Its vapour is exceedingly inflammable, and when kindled, burns with a very white flame and a great deal of smoke, leaving no residuum. The products of its combustion are carbonic acid gas, charcoal, and water. Camphor is soluble in alcohol and in the acids. From these solutions it is precipitated by water. It is also soluble in hot oils, both volatile and fixed, but on cooling separates from them in plumose crystals. It is insoluble in water, and is not acted on by the alkalies, metals, or metallic oxides. By repeated distillation with nitric acid it is converted into camphoric acid. It exists in many vegetables, but is chiefly procured from the *laurus camphora*. *Officinal.*

271. *Starch* is a fine white powder, generally concreted in friable hexagonal columns, smooth to the feel, and emitting a particular sound when compressed. It has neither taste nor smell. It is decomposed by heat. It is not soluble in cold water or in alcohol. Warm water about 190 F. converts it into a kind of mucilage, which on cooling assumes a gelatinous consistence. This jelly, when dried by heat, becomes transparent and brittle like gum, but is not soluble in cold water. Starch, after being thus dissolved in hot water, cannot be reduced to its original state. It is precipitated by infusion of galls, and the precipitate is redissolved on heating the mixture to 120°, but is not soluble in alcohol. At 78 F. its watery solution ferments on the addition of yeast. By roasting it becomes soluble in cold water. Is converted by three or four hours boiling with sulphuric acid into a saccharine liquid. *Officinal:* Wheat, starch, flour, barley, oats.

272. *Asparagin* crystallizes in white, transparent, hard, brittle, rhomboidal prisms; taste cool and nauseous; readily soluble in hot water, sparingly in cold, and insoluble in alcohol. Solution does not affect vegetable blues, infusion of nutgalls, acetate of lead, oxalate of ammonia, muriate of barytes, or hydrosulphuret of potass. Potass disengages no ammonia, but renders it more soluble in water. It dissolves in nitric acid, forming a solution of a yellow colour and bitter taste. It has hitherto been found only in the expressed juice of asparagus.

273. *Inulin* is a white powder, insoluble in cold, but readily soluble in hot water; insoluble in alcohol; burns with the smell of caromel, and yields oxalic acid, when treated with nitric acid.

274. *Sugar* is a hard but brittle substance, of a white colour, disposed to form semi-transparent crystallizations, of a

sweet taste, and without smell. When heated sufficiently it melts, is decomposed, emits a peculiar smell (caromel), and becomes inflamed. Sugar at 40° is soluble in its own weight of water, and in still less at 212°. It is also soluble in about four parts of boiling alcohol. It combines with volatile oils, and renders them miscible with water. It also unites with potass and lime. It is decomposed by the concentrated sulphuric and nitric acids. According to Lavoisier's and Dr Thomson's experiments, it consists of about 64 oxygen, 23 charcoal, and 8 hydrogen. *Officinal:* Sugar, honey, manna.

275. *Sarcocoll* (Dr Thomson) does not crystallize; soluble in water and alcohol. Taste bitter sweet. Soluble in nitric acid, and yields oxalic acid. *Officinal:* Sarcocoll, extract of liquorice.

276. *Jelly* is contained in the juice of acid fruits. It is deposited from them in the form of a soft tremulous mass, almost colourless, and agreeable to the taste. It is scarcely soluble in cold water, but very soluble in hot water; and when the solution cools, it again assumes a gelatinous state. With sugar its combination is well known. By long boiling it loses this property of congealing. When dried, it becomes transparent, hard and brittle, resembling gum. It combines with the alkalies, and is converted by the nitric acid into oxalic acid. *Officinal:* Acidulous fruits.

277. *Tannin*, when completely dried, is a brittle substance, of a black colour, and vitreous fracture; it is soluble in alcohol; it is much more soluble in hot than in cold water. The solution has a dark brown colour, astringent taste, and peculiar smell; it is precipitated by acids, in the form of a viscid fluid, like pitch; it is also precipitated by carbonate of potass in yellow flakes; it forms an insoluble elastic precipitate with gelatin, and dark blue or black precipitates with iron. Mr Hatchett has prepared a species of tannin artificially by the action of nitrous acid on charcoal, and various substances containing charcoal. *Officinal:* Galls, uva ursi, tormentil, rhubarb, sarsaparilla, St Lucie cinchona, swietenia, simarouba, filix mas, kino, catechu, salix.

278. *Emetine*, transparent scales, of a brownish-red colour; scarcely any smell; taste bitter; slightly acrid and not at all nauseous; inalterable in the air; soluble in water and alcohol, but insoluble in ethers; decomposed by the sulphuric and nitric acids, and dissolved by the muriatic and phosphoric acids; precipitated by the gallic acid, by the salts of lead and iodine.

279. *Picrotoxine*, brilliant semitransparent white quadran-

gular prisms, soluble in alcohol and water, solutions of the alkalies in acetic and diluted nitric acids; soluble in oil.

QUATERNARY OXIDES.

280. *Gum*, when pure, is transparent and colourless, easily reduced to powder, without smell and of a slightly sweetish taste. The solution of gum in water constitutes mucilage; it is thick and adhesive, and soon dries when exposed to the air. Gum is also soluble in the weak acids; but is totally insoluble in alcohol, which even precipitates it from mucilage. When triturated with a small quantity of oil or resin, it renders them miscible with water. Gum is very little disposed to spontaneous decomposition; even mucilage may be kept for many years without change; but it is decomposed by the strong acids. By oxygenizement with nitric acid, it forms successively mucic, malic, and oxalic acid; with oxymuriatic acid it forms citric acid. When exposed to heat, it does not melt, but softens, swells, and becomes charred and incinerated. Its products are carbonic acid, and carburetted hydrogen gas, empyreumatic oil, and a considerable quantity of acetic acid, combined with a little ammonia. *Officinal:* Gum arabic, linseed, quinceseed.

281. *Tragacanth* is opaque and white, difficultly pulverizable, not sweetish, is very sparingly soluble in water, but absorbs a large proportion, and forms a paste. Its solution is adhesive, but cannot be drawn out into threads. It moulds readily, and acquires a fetid smell. It is precipitated by nitrate of mercury. It is insoluble in alcohol; and seems to contain more nitrogen and lime than gum does. *Officinal:* Tragacanth.

282. *Ulmin*, a solid, hard, black substance, with considerable lustre; when reduced to powder, brown; insipid, but readily soluble in the mouth; soluble in a small quantity of water; solution transparent, blackish brown, not mucilaginous or adhesive; insoluble in alcohol or ether; convertible into resin by nitric or oxymuriatic acid. Hitherto examined only by Klaproth, and supposed to be a product of the *ulmus nigra.*

283. *Extractive* is soluble in water, especially when hot, and in alcohol; it is also soluble in the weak acids, but is insoluble in ether. It attracts moisture from the atmosphere; and when dissolved in water, it absorbs oxygen, and becomes insoluble in water; it is also altered and precipitated by oxymuriatic acid; it has a strong affinity for alumina, and decomposes several metallic salts. It is found in almost all plants,

but can scarcely be procured separate, so that its characters are not well ascertained. *Officinal:* Saffron, aloes.

284. *Gum-resins*, in strict propriety, should not be noticed here, as they are secondary compounds, and probably vary much in their nature. They seem to be compounds of resin with extractive and essential oil, and perhaps other immediate principles not yet ascertained. *Officinal:* Gum ammoniac, galbanum, scammony, assafœtida, gamboge, myrrh, sagapenum, olibanum.

285. *Bitter principle* (Thomson), intensely bitter, of a yellowish colour, ductile while soft, brittle while dry, not fusible, soluble in alcohol and water, not crystallizable, precipitated by nitrate of silver, acetate of lead. *Officinal:* Quassia, gentian, colocynth, broom, simarouba, dandelion, colomba, marsh, trefoil, lesser centaury, blessed thistle, different species of artemisia, cinchona Jamaicensis.

286. *Narcotic principle*, crystallizable, soluble in about 400 parts of boiling water, in cold water, in 24 parts of boiling alcohol, in hot ether, in all acids, and in hot volatile oils, fusible, not volatile, highly narcotic. *Officinal:* Opium, lactuca, belladona, hyoscyamus, hemlock, stramonium.

287. *Acrid principle*, soluble in alcohol, water, acids, and alkalies, rises in distillation with water and alcohol, not neutralized by alkalies or acids. *Officinal:* Squills, garlic, colchicum, asarum, arum, hellebore, bryony, iris, ranunculus, digitalis, viola, scurvygrass, mustard.

288. *Cinchonin*, not acrid, soluble in alcohol and in water, precipitated by infusion of galls; precipitate soluble in alcohol. *Officinal:* Cinchona officinalis, colomba, angustura, ipecacuan, pepper, opium, capsicum.

289. *Indigo* has a deep blue colour, is slight and friable, without taste or smell, insoluble in water, alcohol, ether, and oils, forming a deep blue solution with sulphuric acid; when precipitated from acids, soluble in alkalies, becoming green. It is obtained from the indigofera tinctoria and isatis tinctoria.

290. *Caoutchouc*, when smoke has not been employed in drying it, is of a white colour, soft, pliable, extremely elastic, and difficultly torn; specific gravity 0.9335; inalterable by exposure to air; insoluble in water, but softened, so that its edges may be made to adhere to each other; insoluble in alcohol; soluble, without alteration, in ether previously agitated with water, and in rectified petroleum; soluble in volatile oils; and fusible by heat, but altered, so that it remains glutinous after evaporation and cooling; inflammable; insoluble in alkalies, and decomposed by the strong acids. It is obtain-

ed principally from Hævea caoutchouc and Jatropha elastica in South America, and the Ficus Indica, Artocarpus integrifolia, and Urceola elastica in the East Indies.

291. *Bird-lime* is a green, gluey, stringy, and tenacious substance, insoluble in water and in cold alcohol; unites readily with the oils, and is soluble in ether, forming a green solution.

292. *Suber* constitutes the epidermis of all vegetables. On the Quercus suber it is thickened by art in a surprising degree, and forms common cork. It is a light elastic substance, very inflammable, burning with a bright white flame, and leaving a very spongy charcoal; it is not soluble in any menstruum; it is decomposed by nitric acid, and is converted into a peculiar acid, and an unctuous substance.

293. *Wood* (lignin?), when separated from all the other matters with which it is combined in vegetables, is a pulverulent, fibrous, or lamellated body, more or less coloured, of considerable weight, without taste or smell, and insoluble in water or alcohol. When exposed to a sufficient heat, it is decomposed without melting or swelling, and is converted into charcoal without any change of form. Its products, by combustion, are carbonic acid and carburetted hydrogen gas, water, empyreumatic oil, and acetic acid. By nitric acid, it is changed into the malic, oxalic, and acetic acids. It forms the skeleton of all vegetables.

294. *Cotton*, a white fibrous substance, without smell or taste, insoluble in water, alcohol, ether, oils, and vegetable acids; soluble in strong alkaline leys, and when assisted by heat, in nitric acid, forming oxalic acid.

295. *Fungine* is more or less white, soft, insipid and little elastic; on distillation it furnishes ammonia; inflammable, and decomposed by nitric acid.

296. *Ferment*, grey white paste, firm and brittle, having a peculiar sourish smell; insoluble in alcohol and in water; exciting the vinous fermentation in syrup, and yielding ammonia on distillation.

297. *Osmazone*, a reddish-brown extract, of an aromatic smell, and a strong taste resembling gravy, easily soluble in water and alcohol, and the solution precipitated by infusion of galls, the nitrate of mercury and acetate and nitrate of lead; it yields ammonia.

298. *Picromel*, resembling turpentine in appearance, heavier than water, without colour, having a nauseous smell and an acrid taste, both sweet and bitter, soluble in water and alcohol; the solutions precipitated by subacetate of lead, nitrate of mercury and salts of iron, but not by infusion of galls or the acetate of lead; it yields little ammonia.

299. *Gelatin*, when exsiccated, is a hard, elastic, semi-transparent substance, resembling horn, having a vitreous fracture: inalterable in the air, soluble in boiling water, and forming with it a gelatinous mass on cooling; it is also soluble, but less readily in cold water. It is soluble in acids, even when much diluted, and also in the alkalies. It is precipitated by tannin, with which it forms a thick, yellow precipitate, soon concreting into an adhesive, elastic mass, readily drying in the air, and forming a brittle substance, of a resinous appearance, resembling over-tanned leather, very soluble in ammonia, and soluble in boiling water. It is also precipitated copiously by carbonate of potass, and by alcohol; both precipitates being soluble in water. The solution of gelatin in water first becomes acid, and afterwards putrid. When decomposed by nitric acid or heat, its products shew that it contains only a small proportion of nitrogen. It is principally contained in the cellular, membranous, and tendinous parts of animals, and forms an important article of nourishment. Glue and isinglass, which are much employed in the arts, are almost pure gelatin. *Officinal:* Isinglass, cornu cervi.

300. *Albumen*, when dried, is a brittle, transparent substance, of a pale yellow colour, and glutinous taste, without smell, readily soluble in cold water, insoluble in boiling water, but softened and rendered opaque and white when thrown into it; insoluble, and retaining its transparency in alcohol; swelling; becoming brown, and decrepitating when suddenly exposed to heat. It generally exists in the form of a viscid, transparent fluid, having little taste or smell, and readily soluble in cold water. When heated to 165°, it coagulates into a white opaque mass, of considerable consistency; it is also coagulated by alcohol and acids, and remarkably by muriate of mercury. Albumen forms with tannin a yellow precipitate, insoluble in water. *Coagulated albumen* is not soluble either in cold or in boiling water. It is soluble, but with decomposition, in the alkalies and alkaline earths. It is also soluble in the acids, greatly diluted, but may be precipitated from them by tannin. When decomposed by nitric acid or heat, it is found to contain more nitrogen than gelatin does. White of egg consists of albumen, combined with a very little soda, sulphur, and phosphate of lime. Albumen also forms a large proportion of the serum of the blood, and is found in the sap of some vegetables. It is highly nutritious. *Officinal:* White of egg.

301. *Fibrin* is of a white colour, without taste or smell, tough and elastic; but when dried, hard and almost brittle. It is not soluble in water or in alcohol. The concentrated

caustic alkalies form with it a kind of fluid viscid soap. It is dissolved even by the weak and diluted acids; but it undergoes some change, by which it acquires the properties of jellying, and being soluble in hot water. By maceration in water, it becomes putrid, and is converted into adipocire. By long boiling in water, it is rendered tough and corneous. When decomposed by heat or nitric acid, it is found to contain a large proportion of nitrogen. It forms the basis of the muscular fibre, and is contained in small quantity in the blood. The gluten of wheat does not seem to differ from it in any important property. It is eminently nutritious.

302. *Urea* is obtained in the form of brilliant micaceous crystals, in groups, forming a mass of a yellowish white colour, adhering to the vessel containing it; difficult to cut or break; hard and granulated in its centre, gradually becoming soft, and of the consistency of honey on its surface; of a strong, disgusting, alliaceous odour; of an acrid, pungent, disagreeable taste. It is deliquescent; and during its solution in water, it causes a sensible diminution of temperature; it is also soluble in alcohol, especially when assisted by heat. On cooling, the alcoholic solution deposites crystals of pure urea. By the application of heat, it melts, swells rapidly, and at the same time begins to be decomposed, emitting an insupportably fetid odour, and is converted into carbonate of ammonia, and carburetted hydrogen gas. Urea is charred by concentrated sulphuric acid; diluted sulphuric acid, aided by heat, is capable of converting it entirely into acetic acid and ammonia; concentrated nitrous acid decomposes it with rapidity; diluted nitric acid, aided by heat, changes it almost entirely into carbonic acid gas and nitrogen gas; muriatic acid dissolves and preserves it; oxymuriatic acid converts it into ammonia and carbonic acid; potass, aided by heat, converts it into the carbonate and acetate of ammonia. It influences the form of the crystallization of the muriates of ammonia and soda. The solution of urea in water varies in colour from a deep brown to a pale yellow, according to its quantity. With eight parts of water it is perfectly fluid; it scarcely undergoes spontaneous decomposition when pure, but the addition of some albumen occasions it to putrify rapidly. By repeated distillation it is entirely converted into carbonate of ammonia. With nitric acid it forms a pearly crystalline precipitate; it also forms precipitates with the nitrates of lead, mercury, and silver. It is not precipitated by tannin or gallic acid. Urea is only obtained from urine by evaporating the solution of a thick extract of urine in alcohol.

COMPOUND ACIDS.

303. The compound acids possess the properties of acids in general; but they are distinguished from the acids with simple bases, by their great alterability.

304. The ternary acids coincide nearly with the vegetable acids, and are characterized by their being converted entirely into water and carbonic acid, when completely decomposed by oxygen. They consist of various proportions of carbon, hydrogen, and oxygen.

305. The quaternary acids coincide nearly with the animal acids; and are characterized by their furnishing ammonia, as well as water and carbonic acid, when decomposed.

TERNARY ACIDS.

306. *Acetic acid* is a transparent and colourless fluid, of an extremely pungent smell and a caustic acid taste, capable of reddening and blistering the skin. It is very volatile, and its vapour is highly inflammable; it combines with water in every proportion; with sugar, mucilage, volatile oils, alcohol; it dissolves boracic acid, and absorbs carbonic acid gas; it is formed by the acidification of sugar, and by the decomposition of some other ternary and quaternary compounds by heat or acids. It is decomposed by the sulphuric and nitric acids, and by heat. In its ordinary state, it has only an acid taste, a pleasant odour, specific gravity 1.0005, congeals and crystallizes at —22°, and is vaporized at 212°. *Officinal.*

307. *Formic acid* is in most respects analogous to acetic acid, but has a peculiar smell, and greater specific gravity, being 1.102 to 1.113.

308. *Oxalic acid* is obtained in prismatic crystals, transparent and colourless, of a very acid taste, soluble in their own weight of water at 212°, and in about two waters at 65°. Boiling alcohol dissolves somewhat more than half its weight, and at an ordinary temperature a little more than one-third. It is soluble in the muriatic and acetic acids. It is decomposed by heat, sulphuric acid, and nitric acid. According to Thomson, it consists of 64 oxygen, 32 carbon, and 4 hydrogen.

309. *Mellitic acid* crystallizes in very fine needles, or small short prisms, of a brownish colour, and a sweetish sour, but afterwards bitterish taste; sparingly soluble in water, and decomposed by heat, but not convertible into oxalic acid by nitric acid.

310. *Tartaric acid* varies in the forms of its crystals; its specific gravity is 1.5962; it is permanent in the air; it is de-

composed by heat; it dissolves readily in water, and the solution, when very weak, is decomposed by the atmosphere; it may be changed by nitric acid into oxalic acid. According to Fourcroy, it consists of 70.5 oxygen, 19.0 carbon, and 10.5 hydrogen. *Officinal:* Exists in tamarinds, grapes, &c.

311. *Pyrotartaric acid*, extremely acid, soluble in water, and crystallizable; melts and sublimes by heat, precipitates nitrate of mercury, but not nitrate of silver or acetate of lead.

312. *Citric acid* crystallizes in rhomboidal prisms, which suffer no change from exposure to the air, and have an exceedingly acid taste. When sufficiently heated, they melt, swell, and emit fumes, and are partly sublimed unchanged, and partly decomposed. Water, at ordinary temperatures, dissolves one half of its weight of these crystals; at 212° twice its weight. The solution undergoes spontaneous decomposition very slowly. Sulphuric acid chars it, and forms vinegar. Nitric acid converts it into oxalic and acetic acids. *Officinal:* Orange and lemon juice, heps, &c.

313. *Malic acid* is a viscid fluid, incapable of crystallization, of a reddish-brown colour, and very acid taste. It exists in the juice of apples, and combined with lime, in that of the common house-leek. It forms precipitates in the solution of the nitrates of mercury, lead, and silver. *Officinal:* Barberry, plumb, sloe, elder, &c.

314. *Gallic acid* crystallizes in brilliant colourless plates, of an acid and somewhat austere taste, and of a peculiar odour when heated. It may be sublimed undecomposed, by a gentle heat. It is not altered by exposure to the air, is soluble in $1\frac{1}{2}$ of water at 212°, and in 12 waters at 60, and in four times its weight of alcohol. It has a strong affinity for metallic oxides, especially those of iron. It precipitates gold, copper, and silver brown, mercury orange, iron black, bismuth yellow, and lead white. *Officinal:* It exists in nutgalls, and in most astringent vegetable substances.

315. *Mucic acid* is a white gritty powder, of a slightly acid taste, soluble in 80 times its weight of boiling water.

316. *Benzoic acid* crystallizes in compressed prisms of a pungent taste and smell. It is fusible, and evaporates by heat, for the most part, without change. It is also inflammable, and burns entirely away. It is permanent in the air. It is very sparingly soluble in cold water; but at 212° it dissolves in about 24 waters. It is also soluble in hot acetic acid. It is soluble, without change, in alcohol, in concentrated sulphuric and nitric acid, and is separated from them by water. *Officinal:* In balsams of Tolu and Peru, benzoin, storax, &c.

317. *Succinic acid* crystallizes in transparent white triangular prisms; may be melted and sublimed, but suffers partial decomposition; more soluble in hot than in cold water: soluble in hot alcohol.

318. *Moroxylic acid* crystallizes in colourless transparent prisms, having the taste of succinic acid, and not altered by exposure to the air; volatile, readily soluble in water and in alcohol.

319. *Camphoric acid* crystallizes in white parallelopipeds of a slightly acid bitter taste, and smell of saffron, efflorescing in the air; sparingly soluble in cold water; more soluble in hot water; soluble in alcohol, the mineral acids, volatile and unctuous oils; melting and subliming by heat.

320. *Suberic acid* is not crystallizable, but is obtained either in the form of thin pellicles, or of a white powder like starch. At 60° it requires 80 times its weight of water for its solution; at 140°, 38; at 212°, only twice its weight. When heated, it melts, and on cooling crystallizes in needles. It may also be sublimed in long needles. It does not precipitate solutions of lime, barytes or strontia or their salts, nor the sulphates of copper and of zinc. It precipitates nitrate of silver, muriate of tin, sulphate of iron, nitrate and acetate of lead, and nitrate of mercury. It is not acted on by nitric acid. It is soluble in alcohol, and in the alkalies, forming with them neutral salts.

321. *Laccic acid* is obtained in the form of a reddish liquor, having a slightly bitter saltish taste, and the smell of new bread, by expression from the white lac of Madras; but on evaporation it assumes the form of acicular crystals. It rises in distillation. It decomposes with effervescence the carbonates of lime and soda It renders the nitrate and muriate of barytes turbid. It assumes a green colour with lime water, and a purplish colour with sulphate of iron; and precipitates sulphuret of lime white, tincture of galls green, acetate of lead reddish, nitrate of mercury whitish, and also tartrate of potash; but this last precipitate is not soluble in potass.

322. *Sebacic acid* has no smell, and a slightly acid taste. It is crystallizable, melts like fat, and is not volatile. It is so soluble in hot water as to become solid on refrigeration. It is also very soluble in alcohol. It precipitates the nitrates of lead, silver, and mercury, and the acetates of lead and mercury. It does not precipitate the waters of lime, baryta, or strontia.

323. *Sorbic acid* was discovered in 1814 by Mr Donovan. In its most concentrated form, it is a deliquescent mass, but is generally liquid, transparent, without colour or smell, in-

crystallizable, and extremely acid. It keeps long; is soluble in water and alcohol; exists in the berries of the mountain ash, also in crab apples.

324. *Cinchonic acid* crystallizes in diverging plates, has a very acid taste, without any bitterness, reddens infusion of turnsole, is decomposed by heat, inalterable in the air, and very soluble in water. Found in several varieties of cinchona bark.

325. *Mellitic acid* crystallizes in radiating slender prisms, has a sweet, acid, bitter taste, is decomposed by heat, little soluble in water, and is not changed by nitric acid.

326. *Fungic acid*, incrystallizable, deliquescent, colourless, very sharp taste. Exists in many fungi.

327. *Meconic acid*, colourless, crystallizable by sublimation in fine needles, precipitates the salts of iron of a cherry red. Found in opium.

328. *Nanceïc acid*, liquid, incrystallizable, almost colourless, and of an intensely acid taste, and decomposed by heat Exists in vegetables which have become acid.

329. *Margaric acid* is solid, and of a pearl white colour, insipid, weak smell like that of white wax, lighter than water, and does not redden tincture of turnsole until it be softened by heat; at 134 Fahr. it melts into a colourless very limpid liquid, which crystallizes on cooling into brilliant crystals of the purest white. It is partly volatilized, and partly decomposed by heat.

330. *Oleïc acid* is a pale yellow fluid, with a rancid smell and taste; sp. gr. 0.898; reddens infusion of litmus; insoluble in water, and very soluble in alcohol; below 43 Fahr. it concretes into white acicular crystals.

331. *Cetic acid* is without taste or smell; melts at about 113 Fahr., insoluble in water, soluble in less than its weight of boiling alcohol; the solution reddens turnsole, and on cooling deposites brilliant lamellar crystals.

332. *Rosacic acid*, solid, of a cinnabar colour, without smell, and almost without taste, reddens infusion of turnsole, deliquescent, very soluble in water and alcohol, and forming soluble salts with the alkalies, precipitating acetate of lead of a rose colour, forming with uric acid a compound scarcely soluble in water, convertible into uric acid by nitric acid, and furnishing no ammonia by destructive distillation.

CYANIC ACIDS.

333. *Hydrocyanic acid or prussic acid* is a colourless fluid, of a strong smell, like that of bitter almonds, and a sweetish pungent taste. It does not redden vegetable blues. It con-

sists of carbon, azote, and hydrogen. It is easily decomposed by light, heat, and chlorine. It does not act upon the metals, but forms coloured, and generally insoluble combinations with their oxides. It is obtained from animal substances by the action of heat, nitric acid, fixed alkalies, and putrefaction. *Officinal:* Bitter almonds, Prunus lauro-cerasus.

334. *Ferrocyanic acid* is composed of the elements of prussic acid and the black oxide of iron. It is of a pale lemon colour, has no smell, and is decomposed by a gentle heat or strong light. It forms directly with alkalies and earths the salts termed triple prussiates.

335. *Sulphocyanic acid* is composed of the elements of prussic acid and sulphur. It is colourless or pinkish, sp. gr. 1.022, smell pungent like strong acetic acid. These two acids were discovered by Mr Porret.

336. *Chlorocyanic acid* is a colourless liquid, having a very pungent smell. It reddens infusion of litmus. It precipitates iron green.

QUATERNARY ACIDS.

337. *Amnic acid* is obtained in white, brilliant, acicular crystals, of an acid taste, reddening the tincture of turnsole, sparingly soluble in cold water, but somewhat more soluble in hot water. It is soluble in alcohol. It is decomposed by heat.

338. *Uric acid,* white hard scales, without smell or taste, almost insoluble in cold, and very sparingly soluble in boiling water, but becoming very soluble when combined with an excess of potass or soda; insoluble in alcohol and inalterable in the air. It is decomposed at a high temperature, and furnishes carbonate of ammonia, and carbonic acid: and by nitric acid and chlorine.

COMPOUND ALKALIES.

336. *Morphine,* solid and colourless, crystallizes in truncated transparent and very beautiful pyramids, easily fusible, and crystallizing on cooling; decomposed by fire, yielding ammonia; inflammable; insoluble in cold, and sparingly soluble in hot water; very soluble in alcohol and ether; its solutions affect the vegetable colours as alkalies do, and it neutralizes acids, forming with them crystallizable salts. It is got from opium.

340. *Strychnine.* It is white, inodorous, and of an insupportable bitterness; crystallizes in four-sided prisms, terminated by four-sided elliptical pyramids, is soluble in alcohol, but

not very soluble in water or ether. It exerts no action on turmeric, gives a green colour to the vegetable blues, and restores the blue to paper which has been reddened by an acid. It dissolves very quickly in acids, saturates them, and forms with them neutral salts, which are more or less crystallizable. Weak nitric acid dissolves without altering it, but a concentrated acid imparts to this substance a blood red colour. When the action is continued, the solution becomes yellow, and leaves a product of oxalic acid. It is got from various species of the genus strychnos.

CHARACTERS OF SECONDARY SALTS DERIVED FROM THEIR ACIDS.

341. The *nitrites* are characterized by their emitting the nitrous acid in orange fumes, on the addition of sulphuric acid.

342. The *nitrates*, by the action of fire, furnish impure oxygen gas, mixed with nitrogen, and are reduced to their bases. By the action of concentrated sulphuric acid, they emit a white vapour; and they are capable of supporting combustion. *Officinal:* Nitrates of potass and of silver.

343. The *carbonates* always preserve their alkaline properties in some slight degree. They are decomposed by all the acids, forming a brisk effervescence, which is colourless. The carbonates of the metals very much resemble their oxides. *Officinal:* Carbonates of baryta, of lime, of magnesia, of potass, of soda, of ammonia, of zinc, of iron.

344. *Borates* are vitrifiable; and their concentrated solutions afford, when heated with the strong sulphuric acid, brilliant lamellated crystals. *Officinal:* Sub-borate of soda.

345. The *sulphites*, by the action of heat, furnish sulphur, and become sulphates. They are also converted into sulphates, with effervescence and exhalation of sulphurous vapours, by the sulphuric, nitric, muriatic, and other acids, and by exposure to the atmosphere gradually, when dry, and very quickly, when dissolved. *Officinal:* Sulphate of potass with sulphur.

346. The *sulphates* form sulphurets when heated to redness with charcoal, and furnish copious precipitates with solutions of baryta. *Officinal:* Sulphates of baryta, potass, soda, zinc, copper, iron, mercury.

347. The *phosphites* are fusible, and, when heated in close vessels, furnish a little phosphorus, and become phosphates. When heated in the open air, they emit a phosphorescent light, and often flashes of flame, accompanied by a strong smell of garlic, and a thick white vapour, and are converted into phosphates.

348. The *phosphates* are crystallizable, fixed, fusible, vitrifiable and phosphorescent. They are not decomposed by charcoal. They are soluble in nitric acid, without effervescence, and precipitable from that solution by lime water. *Officinal:* Phosphate of soda.

349. The *arsenites* are decomposed by heat, and by all the acids.

350. The *arsenates* are decomposed by charcoal at a high temperature.

351. The *molybdates* are generally colourless and soluble, and are precipitated light brown by prussiate of potass.

352. The *chromates* are of a yellow or orange colour.

353. *Columbate* of potass resembles boracic acid in its appearance.

354. *Acetates* are very soluble in water; are decomposed by heat, by exposure of their solutions to the air, and by the stronger acids. *Officinal:* Acetate of potass, lead, zinc, mercury.

355. *Formates* strongly resemble the acetates.

356. *Oxalates* are decomposed by heat; form, with lime-water, a white precipitate, which, after being exposed to a red heat, is soluble in acetic acid. The earthy oxalates are very sparingly soluble in water; the alkaline oxalates are capable of combining with excess of acid, and become less soluble.

357. *Mellates*, crystallizable.

358. *Tartrates*, by a red heat, are converted into carbonates. The earthy tartrates are scarcely soluble in water: the alkaline tartrates are soluble; but when combined with excess of acid, they become much less soluble. The tartaric acid is capable of combining at the same time with two bases. *Officinal:* Supertartrate of potass, tartrate of potass and soda.

359. *Pyrotartrate of potass*, soluble in alcohol, precipitates acetate of lead, but not the salts of barytes and lime.

360. *Citrates* are decomposed by the stronger mineral acids, and also by the oxalic and tartaric, which form an insoluble precipitate in their solutions. The alkaline citrates are decomposed by a solution of barytes.

361. *Malates* having alkalies for their base, are deliquescent. The acidulous malate of lime is soluble in cold water.

362. *Gallates* have not been particularly examined.

363. *Mucates* of potass and soda are crystallizable. Mucates with earthy and metallic bases are nearly insoluble.

364. *Benzoates*, little known, but generally forming feather-shaped crystals, and soluble in water.

365. *Succinates*, little known.

366. *Moroxylate* of lime, needle-formed crystals, permanent in the air, soluble in water, and precipitating the solutions of silver, mercury, copper, iron, cobalt, and uranium in nitric acid, and of lead and iron in acetic acid.

367. *Camphorates* have commonly a bitter taste, burn with a blue flame before the blowpipe, and are decomposed by heat, the acid subliming.

368. *Suberates* have in general a bitter taste, and are decomposed by heat.

369. *Laccate* of lime bitterish; of soda deliquescent.

370. *Sebates* are soluble salts.

371. *Prussiates* of alkalies are easily decomposed even by carbonic acid. They form variously coloured precipitates in the solutions of the metallic salts, except those of platinum.

372. *Amnates.* Very soluble in water, and the acid is precipitated from them in the form of a white crystalline powder, by the other acids.

373. The *urates* are almost insoluble in water. The sub-urates of soda and potass are very soluble, and the uric acid is precipitated from the solutions even by the carbonic acid.

374. *Rosates*, unknown.

375. The *muriates* have a more or less pure salt taste. They are not acted upon by any combustible body. They are all soluble in water, and are the most volatile and most difficultly decomposed by heat of the neutral salts. They emit white fumes with the sulphuric acid, and oxymuriatic acid gas with the nitric. *Officinal:* Muriates of ammonia, soda, baryta, lime, mercury, antimony. According to Sir H. Davy's view, the first only is a muriate, or combination of muriatic acid; the others are chlorides of the respective metals.

376. *Oxymuriates* or *Chlorates* give out very pure oxygen gas by the action of caloric, and become muriates. They do not destroy vegetable colours. Their acid is expelled from them with noise, by the stronger acids; and they inflame combustible bodies, even spontaneously, and with detonation.

377. *Fluates* afford, when treated with concentrated sulphuric acid, a vapour which corrodes glass, and from which the silica is afterwards precipitated by water.

378. *Fluo-borate of ammonia*, decomposed by heat; fluate of ammonia subliming, and boracic acid remaining behind.

379. *Iodates* are crystallizable, very insoluble; by the action of fire, melt and decompose easily. They detonate by percussion with combustible bodies; precipitate with silver white, and very soluble in ammonia.

380. *Hydriodates*, soluble in water, precipitate silver white, and insoluble in ammonia.

CHARACTERS OF SALTS DERIVED FROM THEIR BASES.

CLASS FIRST. *Alkaline salts.* Soluble in water, not precipitated by potass, or oxalic acid.

GENUS I. *Potass.* Sapid, bitter, crystallizable, fusible, calcinable, vitrified, or reduced to their base by heat, decomposed in general by baryta, rarely by lime. *Officinal:* Sulphate, nitrate, carbonate, supertartrate, tartrate, acetate.

G. II. *Soda.* Sapid, bitter, crystallizable, commonly containing much water of crystallization, and therefore efflorescent, and undergoing the watery fusion and exsiccation before they are melted by the fire, decomposed by baryta and potass. *Officinal:* Sulphate, muriate, phosphate, carbonate, tartrate, sub-borate.

G. III. *Ammonia.* Sapid, acrid, very soluble, either sublimed unchanged, or decomposed, losing their base partially or totally by heat, base also expelled by baryta, potass, soda, strontia, and lime. *Officinal:* Muriate, carbonate, acetate, hydrosulphuret.

CLASS SECOND. *Earthy Salts.* Either insoluble in water, or, if soluble, precipitated by sulphuric acid and carbonate of potass.

GENUS I. *Baryta.* Generally insoluble in water, and indecomposable by fire; all poisonous, and decomposed by the alkaline carbonates. *Officinal:* Sulphate, carbonate, and muriate.

G. II. *Strontia.* Generally insoluble in water, and indecomposable by fire; not poisonous, and decomposed by the alkaline carbonates, potass, soda, and baryta.

G. III. *Lime.* Generally sparingly soluble in water, decomposed by the alkaline carbonates, potass, soda, baryta, and strontia, and by oxalic acid. *Officinal:* Carbonate, muriate, phosphate.

G. IV. *Magnesia.* Generally soluble in water, and bitter; decomposed by baryta, potass, soda, strontia, and partially by ammonia. Magnesian salts, when added to ammoniacal salts, containing the same acid, quickly deposite crystals of a triple ammoniaco-magnesian salt. *Officinal:* Sulphate, carbonate.

G. V. *Glucina.* Taste sweetish; decomposed by all the preceding bases; when recently precipitated by an alkali, soluble in carbonate of ammonia, precipitated by an infusion of nut-galls, and succinate of potass.

G. vi. *Alumina.* Generally soluble in water, taste sweetish and styptic; decomposed by all the preceding bases; when recently precipitated, soluble in the alkalies, and in sulphuric acid, precipitated by hydrosulphuret of potass. *Officinal*: Supersulphate.

G. vii. *Yttria.* Sweetish styptic taste; decomposed by all the preceding bases; precipitated by prussiate of potass and iron, and by infusion of galls.

G. viii. *Zirconia.* Taste austere; decomposed by all the preceding bases; precipitate not soluble in the alkalies, and when redissolved in muriatic acid, precipitated by hydrosulphuret of potass, prussiate of potass and iron, and infusion of galls.

G. ix. *Silica.* Forms only one salt with fluoric acid, which is crystallizable, soluble in excess of acid, and in the alkaline fluates.

Class third. *Metalline salts.*

1. Soluble in water, precipitated by hydrosulphuret of potass;
2. Insoluble in water, fusible with borax into a coloured glass, or with charcoal into a metallic button.

Genus i. *Gold.* Soluble in water, solution yellow, metal precipitated by sulphate of iron, sulphurous acid, and infusion of galls; prussiate of potass and iron gives a yellowish-white, and muriate of tin a purplish precipitate.

G. ii. *Platinum.* Solution in water brownish, not precipitated by prussiate of potass and iron, or infusion of galls, coloured bright red by muriate of tin, metal precipitated by sulphuretted hydrogen, precipitated orange by prussiate of mercury, and in small red crystals by potass and ammonia.

G. iii. *Silver.* Metal precipitated by copper and sulphate of iron. Precipitated white by muriatic acid and the prussiates, black by hydrosulphuret of potass, and yellowish-brown by infusion of galls. *Officinal:* Nitrate.

G. iv. *Copper.* Soluble in water; solution blue or green, rendered bright blue by ammonia, metal precipitated by iron, precipitated black by hydrosulphuret of potass, greenish-yellow by prussiate of potass and iron, green by alkaline arsenites and arseniates, and brown by oxalic acid. *Officinal:* Sulphate, ammoniaret.

G. v. *Iron.* Soluble in water. Solution green or brownish red; precipitated blue by the triple prussiates, and purple or black by infusion of galls. *Officinal:* Sulphate, tartrate, acetate, carbonate

G. VI. *Lead.* Insoluble salts easily reduced. Soluble salts colourless; precipitated white by triple prussiate, infusion of galls and zinc, and black by hydrosulphuret of potass. *Officinal:* Acetate, subacetate.

G. VII. *Tin.* Soluble, not precipitated by infusion of galls; precipitated white by triple prussiate and lead, black by hydrosulphuret of potass, and brown by sulphuretted hydrogen.

G. VIII. *Zinc.* Soluble; colourless; not precipitated by any metal or infusion of galls; precipitated white by alkalies, triple prussiate, hydrosulphuret of potass, and sulphuretted hydrogen. *Officinal:* Sulphate, acetate.

G. IX. *Mercury.* Volatile; precipitate by copper metallic, by triple prussiate and muriatic acid white, by hydrosulphuret of potass black, and by infusion of galls orange. *Officinal:* Muriate, submuriate, subsulphate, subnitrate.

G. X. *Tellurium.* Not precipitated by triple prussiate. Precipitate by zinc black and metallic, by hydrosulphuret of potass brown, by infusion of galls yellow, and by alkalies white, and soluble when the alkali is added in excess.

G. XI. *Antimony* Precipitate by iron or zinc black, by hydrosulphuret of potass orange. *Officinal:* Muriate, phosphate, tartrate.

G. XII. *Bismuth.* Solution, colourless. Precipitate by copper metallic, by water and triple prussiate white, by infusion of galls orange, and by hydrosulphurets black.

G. XIII. *Manganese.* Soluble, not precipitated by gallic acid. Precipitated by alkalies, triple prussiate, and hydrosulphurets, white.

G. XIV. *Nickel.* Salts soluble; colour green, precipitate by triple prussiate dull green, by hydrosulphuret black, by infusion of galls greyish-white, and by iron, &c. metallic.

G. XV. *Cobalt.* Soluble, reddish, precipitated by alkalies blue or reddish-brown, by triple prussiate brown with a shade of blue.

G. XVI. *Uranium.* Soluble, yellow, precipitate by alkalies yellow, by alkaline carbonates white, soluble in excess of alkali, by triple prussiate brownish red, by hydrosulphuret of potass brownish yellow, and by infusion of glass chocolate.

G. XVII. *Titanium.* Precipitate by alkaline carbonates flaky, white; by triple prussiate and hydrosulphuret green, and by infusion of galls reddish-brown, solution coloured red by tin, and blue by zinc.

G. XVIII. *Chromium*. Precipitate by triple prussiate and hydrosulphuret green, and by infusion of galls brown.

G. XIX. *Molybdenum*. Solutions blue, precipitate by triple prussiate and tincture of galls brown.

G. XX. *Tungsten*. Unknown.

G. XXI. *Arsenic*. Precipitate by water and triple prussiate white, by hydrosulphuret of potass yellow, by sulphate of copper green, by nitrate of silver yellow.

G. XXII. *Columbium*. Colourless; precipitate by alkaline carbonates and zinc white, by triple prussiate green, by hydrosulphuret of ammonia chocolate, and by tincture of galls orange.

G. XXIII. *Iridium*. Muriatic and sulphuric solution green, nitric red; precipitate by alkalies green and red.

G. XXIV. *Osmium*. Alkaline solution coloured purple and vivid blue by infusion of galls.

G. XXV. *Rhodium*. Triple salt with soda and muriatic acid not precipitated by prussiate of potass, muriate or hydrosulphuret of ammonia, or alkaline carbonates, but by pure alkalies yellow.

G. XXVI. *Palladium*. Acid solutions red; precipitated by prussiate of mercury yellowish-white; by prussiate of potass, brown.

G. XXVII. *Cerium*. Acid solutions precipitated by alkalies white.

SECT. II.

PHARMACEUTICAL OPERATIONS.

COLLECTION AND PRESERVATION OF SIMPLES.

381. EACH of the kingdoms of nature furnishes substances which are employed in medicine, either in their natural state, or after they have been prepared by the art of pharmacy.

382. In collecting these, attention must be paid to select such as are most sound and perfect, to separate from them whatever is injured or decayed, and to free them from all foreign matters.