the sulphur gradually to the oil heated in a large iron vessel, and stir constantly with a spatula until they unite.

This process, though apparently simple, is attended with some difficulty, the oil being very liable to boil over, or its vapour to catch fire: the heat therefore requires to be applied with caution, and a large vessel ought to be employed. It is one too unnecessary, for although the composition has been recommended in catarrh, asthma, and phthisis, it has fallen altogether into disuse. It is extremely acrid and offensive. When employed, it was given in a dose of from ten to thirty drops.

## CHAP. XIX.

### SALES ET SALINA.—OF SALTS AND SALINE SUBSTANCES.

THE term Salt has long been employed, in chemical language, to denote an extensive order of substances; yet it is difficult to assign to it a precise definition, or to distinguish these by characters at once sufficiently comprehensive and appropriate. It is from a combination of the following properties, however, that the definition has been attempted to be formed.

Salts are said to be bodies eminently sapid, or which excite a strong penetrating taste when applied to the tongue. Many of them have indeed this power, but there are others, particularly among the earthy salts, in which any degree of sapidity is scarcely perceptible, while there are many bodies highly sapid which are not of a saline nature.

2d, All salts are supposed to be soluble in water, and this, strictly speaking, is perhaps true; but in many of them, the degree of solubility is so inconsiderable, that it cannot be assigned as a distinctive character of the order. Sulphate of barytes, for example, is not soluble in five thousand times its weight of water, and there are several others nearly equally insoluble.

3d, Salts are said to be capable of assuming a crystalline form. When dissolved in water, many of them, on evaporation of part of the water, concrete into regular crystals. But there are others which, either from being sparingly soluble in that fluid, or from having a strong attraction to it, cannot be easily made to crystallize; while there are substances crystallizable even from their watery solution, sugar, for example, not saline.

4th, Salts are said to be fusible by the application of heat. But the same character may be assigned to almost every other substance which heat does not decompose; and there are many salts, which, instead of being fused, are decomposed in a high temperature.

Lastly, Salts have been considered as uninflammable; and many of them must be so, as they are formed of substances already saturated with oxygen; but there are others, as ammonia and the vegetable acids, as well as the compounds of these, which are more or less inflammable; some of them even burn with a bright flame.

It is evident, therefore, that those properties which have been assigned as characteristic of the order, are not possessed by every substance which, in chemical arrangements, is regarded as saline, but that the exceptions are very numerous. Neither are they possessed exclusively by these substances; there being bodies not saline which are sapid, soluble in water, fusible by heat, uninflammable, and which have even a tendency to assume the crystalline form.

The characters of this order, therefore, are now drawn rather from the chemical composition of the substances arranged under it. It is thus understood as comprehending the acids, the alkalis, and the compounds resulting from the combination of acids with alkalis, earths, and metallic oxides. The acids and alkalis are named Simple or Primary Salts; the others Secondary, or more commonly Neutral Salts, as in general the properties of the acid, and of the alkali, earth, or metal of which they are formed, are neutralized or lost. These are the substances comprized under the present chapter, with a few associated with them for convenience, though not strictly connected with them. They are generally speaking preparations of importance; but differing widely in chemical constitution and medicinal powers, they admit of no general observations.

ACIDUM ACETOSUM DESTILLATUM. Distilled Acetous Acid. Ed.

Distil eight pounds of Acetous Acid in glass vessels with a slow fire. The two pounds that first come over are to be rejected as too watery; the four pounds which follow are the distilled acetous acid. The residuum affords a still stronger acid, but too much burnt.

ACIDUM ACETICUM. Acetic Acid. Lond.

Take of Vinegar, a gallon. Distil the acetic acid in a sand-bath, from a glass retort into a glass receiver kept cold; the first pint being rejected, keep the six pints that are next distilled.

ACETUM DISTILLATUM. Distilled Vinegar. Dub.

Take of Wine Vinegar, ten pints. Distil six pints with a gentle heat, employing glass vessels in the distillation, and rejecting the first pint which comes over. The specific gravity of this acid is to that of distilled water as 1006 to 1000.

Vinegar, Acetous Acid as it is improperly named, consists, as it is produced by fermentation, of acetic acid, largely diluted with water, and mixed with tartaric acid, extractive, mucilaginous, and saccharine matter. From the latter it is purified by distillation, at least it retains in combination only a very small portion of extractive matter. The distilled liquor is however weaker than the vinegar itself, a larger portion of the acid remaining in the residual liquor; and, in general, it receives from the distillation somewhat of an empyreumatic odour. It is usual, on the large scale, to perform the distillation in a tin still, connected with a tin spiral tube in a refrigeratory, and to add portions of boiling water during the distillation, so as to dilute the residual liquor, and bring over the whole of the acid. The process, however, ought to be conducted in glass vessels, as directed in the Pharmacopœias; as, from metallic ones, (tin, which has been employed, being often alloyed with lead), the acid may receive an impregnation that might prove noxious: the conducting the distillation so as to obtain a larger quantity of the acid than is ordered by the College may be allowed. It appears from Mr Phillips' experiments, that the process as given by the Colleges is attended with an unnecessary waste of acid: even the first eighth part ordered by the London College to be rejected has a sensible degree of acidity, a fluidounce of it decomposing from 4½ to 5 grains of carbonate of lime, and a fluidounce of the latter products not decomposing more than 8 grains. When one-fourth is rejected, as directed by the Edinburgh College, the loss is of course still greater. And this is without any adequate advantage, as distilled vinegar is not applied to any use in which it is of importance that it should be of great strength.

Distilled vinegar is colourless, not very sour to the taste; its odour usually slightly empyreumatic. It is chiefly employed as a solvent of some vegetable substances, and in making some of the salts. Sometimes it is applied externally, in preference to common vinegar, as a discutient, and as an application to burns. It has the advantage, as a pharmaceutic agent, not only of greater purity, but of not being liable, like undistilled vinegar, to spontaneous decomposition.

**Acidum acetosum forte.** Strong Acetous Acid. Ed.

Take of Dried Sulphate of Iron, one pound; Acetate of Lead, ten ounces. Rub them together. Put them into a retort, and distil from sand with a moderate fire, as long as any acid comes over.

**Acidum aceticum.** Acetic Acid. Dub.

Take of Acetate of Potash, six ounces; Sulphuric Acid, three ounces. Put the acid into a tubulated retort, and add to it gradually, and in different portions, the acetate of potash, allowing the mixture to cool after every addition; then distil the acid with a moderate heat, until the residuum is dry. The specific gravity of this acid is to that of distilled water as 1070 to 1000.

These are two processes for obtaining acetic acid in a concentrated state, and others have been likewise employed. One giving a stronger acid than either of them has been long in use, and had a place in the former edition of the London Pharmacopœia. It consists in exposing verdigrease, which is a sub-acetate of copper, well dried, to a heat gradually raised, and purifying the acid which distils over by a second distillation; the high temperature in this process expelling the acetic acid from the metallic salt. In the first of the above processes, that of the Edinburgh Pharmacopœia, the expulsion of the acetic acid from the acetate of lead is favoured by the affinity exerted to the oxide of lead by the sulphuric acid of the sulphate of iron; and as these salts are dried, or contain little water of crystallization, the acid is supposed to be obtained in a concentrated state. In the process given by the Dublin College, the sulphuric acid combines with the potash of the acetate of potash, and disengages the acetic acid. This distils over; and as the acetate of potash contains little water, and the water of the sulphuric acid must be in part retained by the affinity exerted to it by the sulphate of potash, the acetic acid is obtained in a concentrated form.

Chemists had observed some difference of properties between the acetic acid obtained from the decomposition of verdigrease by heat, radical vinegar as it was named, and the acid of vinegar purified by distillation, and concentrated by freezing, or obtained in a concentrated state by the decomposition of an acetate having an alkaline or earthy base. They were therefore regarded as chemically different; the one, that obtained from the metallic salt, was believed to be more highly oxygenated, in consequence of receiving, it was supposed, oxygen from the metallic oxide, and was named Acetic Acid; while the other was named Acetous Acid. At a later period, it was supposed that they differed rather in the proportion of carbon existing in their base. But the experiments, first of Adet, and since of Darracq, have proved, that they differ merely in degree of concentration, (that expelled from the metallic salt by heat being strongest), and sometimes in a small quantity of extractive matter adhering to the acid concentrated by freezing. When freed from this, and when brought to the same specific gravity by diluting the stronger, they have the same properties, display the same affinities, and afford the same products by analysis. There is therefore only one acid, the Acetic, and the name Acetous is not properly applied.

The process of the Edinburgh College affords an acid not so highly concentrated, and therefore not so pungent as that in which it is procured by exposing verdigrease to heat: it is also liable to be empyreumatic. That procured by the process of the Dublin College is stronger; it is also more fragrant: it has the advantage of not being liable to be contaminated by any metallic impregnation; and it is free from sulphurous acid, with a portion of which the other is sometimes impregnated. A process, which would afford it equally pure, and probably stronger, would be to decompose the solid acetate of lime by sulphuric acid, as the sulphate of lime, which would be formed by its strong affinity to water, would detain it; or the acid may be brought to the highest state of concentration, by distilling it from dry muriate of lime.

Acetic acid, in its highly concentrated state, has a fragrant, and, at the same time, very sharp penetrating odour; its taste is extremely sour and pungent, and it is so acrid as to inflame the skin. It is highly volatile, evaporating at the common temperature of the atmosphere: it is also inflammable, it at least kindles when a burning body is approached to its vapour. It exerts the agencies of a powerful acid, and it has a very peculiar action on several of the proximate principles of vegetables, whence it can be applied to pharmaceutical purposes,—dissolving them, without decomposing them, or materially altering their properties. It thus dissolves resins, gum-resins, camphor, and essential oils. It is employed medicinally, principally as a stimulating perfume in languor or faintness, or to obviate the unpleasant smell of confined or corrupted air. The combination of it with camphor is principally used for this purpose, as has been noticed under the chapter of medicated vinegars; the camphor being merely dissolved in the strong acid. Henry's Aromatic Spirit of Vinegar is a preparation of a similar kind, rather more fragrant and more grateful.

Acidum benzoicum. Benzoic Acid. Ed.

Take of Benzoin, twenty-four ounces; of Carbonate of Soda, eight ounces; Water, sixteen pounds. Boil the benzoin, rubbed with the carbonate, in water for an hour, stirring them constantly, and strain. Boil the residual balsam in other six pounds of water, and strain. Mix this when strained with the former liquor, and evaporate until two pounds remain. Strain again, and drop into the liquor, as long as there is any precipitation, diluted sulphuric acid. Dissolve the precipitated benzoic acid in boiling water. Strain the liquor while hot, through linen, and put it aside, that crystals may form. These crystals being collected, and washed with cold water, dry and preserve them.

Acidum benzoicum. Benzoic Acid. Lond.

Take of Benzoin, a pound and a half; Newly Prepared Lime, four ounces; Water, a gallon and a half; Muriatic Acid, four fluidounces. Rub the benzoin with the lime; then boil for half an hour in a gallon of water, stirring constantly with a rod, and strain the liquor, when cold. Boil what remains in four pints of water, and pour off the liquor as before. Boil down these liquors mixed together to half the quantity, then strain through paper, and drop in gradually muriatic acid, till there is no farther precipitation. Lastly, having poured off the liquor, dry the powder with a gentle heat, and put it into a proper vessel placed in sand; then sublime the benzoic acid with a gentle heat.

ACIDUM BENZOICUM. Benzoic Acid. Dub.

Take of Benzoin, any quantity. Melt it in a retort, with a wide neck, to which adapt a receiver without luting it, and sublime. Let the sublimed matter be occasionally removed from the neck of the retort, that it may not condense in too large quantity. This, if it is stained with oil, press wrapt in bibulous paper, to separate the oil, and again sublime.

This last process is the one by which benzoic acid used to be obtained,—the acid being merely disengaged by heat. Scheele proposed as more economical, the process which has a place in the London Pharmacopœia, and of which that in the Edinburgh Pharmacopœia is the same with some slight modifications. In the one, that given by the Edinburgh College, the acid of the benzoin combines with the soda of the carbonate of soda, forming a soluble salt; the sulphuric acid when added combines with the soda, and the benzoic acid, being sparingly soluble in cold water, is precipitated. In the other, that given by the London College, the benzoic acid combines with the lime, and forms a soluble salt: this cannot, however, be decomposed by sulphuric acid, as the sulphate of lime, being sparingly soluble, would be mingled by precipitation with the benzoic acid; muriatic acid, therefore, is added, which combines with the lime; the muriate of lime remains dissolved, and the benzoic acid is thrown down.

The quantity of benzoic acid obtained by sublimation is greater than can be obtained by the other methods, the product, according to Mr Brande's experiments, amounting to two ounces from a pound of benzoin, while, according to the others, it is equal only to from one ounce five drachms, to one ounce six drachms and a half. But there is a difficulty in conducting the process by sublimation, from a portion of the oily matter of the benzoin being liable to rise with the acid in vapour, and communicating to it a brown tinge. By managing the heat, however, with due precaution, and changing the receiver towards the end of the sublimation, this may be avoided, at least so far as to obtain a pure product, nearly equal in quantity to that from the other methods; and as the sublimed acid is more white and brilliant than the precipitated acid, even when the latter is dissolved and crystallized, this method is still usually followed by the practical chemist, and is even more economical than the others. The London College give the precipitated acid the same brilliant appearance by sublimation.

Benzoic acid is in slender needle-like crystals, or in soft flakes, of a white colour and silky lustre; its taste is pungent and acidulous, its odour aromatic, and when it is heated, penetrating: this odour, however, appears to arise from a minute portion of oily matter adhering to it, as by dissolving the acid in alkohol, and precipitating it by water, it is obtained nearly inodorous. It is volatile and inflammable, is scarcely sensibly soluble in cold water, but is dissolved abundantly by hot water, and is also soluble in alkohol. It has been regarded as a stimulating expectorant, but is totally destitute of medicinal efficacy, and the sole consumption of it is in the composition of the paregoric elixirs of the Pharmacopœias, in which it has long been an ingredient, and is, apparently for no other reason than this, still retained.

ACIDUM CITRICUM. Citric Acid. Lond.

Take of Lemon Juice, a pint; Prepared Chalk, an ounce; or as much as may be sufficient to saturate the juice; Diluted Sulphuric Acid, nine fluidounces. Add the chalk to the lemon juice heated, and mix them; then pour off the liquor. Wash the citrate of lime which remains with water, frequently added;

then dry it. To the dried powder add the diluted sulphuric acid; boil for ten minutes; express the liquor strongly through linen, and strain through paper. Evaporate the strained liquor so far, that on cooling, crystals shall form. To obtain these crystals pure, dissolve them in water a second and third time; strain the solution each time; evaporate, and put it aside to crystallize.

The juice of the lemon consists principally of citric acid, from which, however, it is difficult to abstract the mucilaginous and extractive matter, so as to render it capable of being preserved. Hence the process of obtaining the acid in a pure crystallized form, originally proposed by Scheele, has been introduced into the London Pharmacopœia. The lime, of the carbonate of lime added to the lemon juice, combines with the citric acid, and forms citrate of lime, which, being insoluble, is precipitated; the precipitate is washed to carry off the adhering vegetable matter, and is submitted to the action of diluted sulphuric acid: the sulphuric acid combines with the lime, and disengages the citric acid; this, dissolved by the water, is pressed out from the sulphate of lime, and by the evaporation of the solution is brought to crystallize. The crystals are at first of a brownish tinge, from the re-action, it has been supposed, of the sulphuric on the citric acid. By a second or third solution and crystallization they are obtained colourless, or rather white. A slight excess of sulphuric acid, Scheele found to be useful; and its operation, as Dizé has remarked, consists in decomposing a little mucilage or extractive matter, which adheres to the citric acid, and opposes its crystallization. It remains in the residual liquor without rendering the crystals impure.

Citric acid crystallizes in rhomboidal prisms; it is easily soluble in water, has a taste extremely sour, and reddens deeply the vegetable colours. In its solid state it remains unchanged, and even in solution is not very liable to spontaneous decomposition. It is used, as has already been remarked, as a refrigerant. A grateful lemonade is prepared from it, by dissolving 30 or 40 grains in a pint of water, with the addition of a little sugar, an agreeable flavour being communicated by a little dried lemon peel having been infused in the water, or a powder formed by rubbing sugar on the fresh lemon being dissolved in it. It is used, too, in forming the common effervescing draught, being mixed with carbonate of soda, and water added. Whether it acts with equal certainty with the recent juice, as a remedy in scurvy, remains to be ascertained.

Acidum muriaticum. Muriatic Acid. Ed.

Take of Muriate of Soda, two pounds; Sulphuric Acid, sixteen ounces; Water, one pound. First expose the muriate of soda in a pot to a red heat for a short time; when cold put it into a retort. Then pour the acid, mixed with the water, and cold, on the muriate of soda. Distil from a sand-bath with a moderate fire, as long as any acid comes over. The specific gravity of the acid is to that of distilled water as 1170 to 1000.

Acidum muriaticum. Muriatic Acid. Lond.

Take of Dried Muriate of Soda, two pounds; of Sulphuric Acid; a pound and a half; of Distilled Water, a pint and a half. Mix the acid with half a pound of the water in a glass retort, and add to these when cold the muriate of soda. Pour what remains of the water into a receiver; then a retort being adapted to it, transmit into this water the muriatic acid distilled from a sand-bath, with a heat gradually increased, until the retort become red. The specific gravity of muriatic acid is to the specific gravity of distilled water as 1.170 to 1.000. If into a fluidounce of it, diluted with water, a piece of marble be thrown, half an ounce ought to be dissolved.

ACIDUM MURIATICUM. Muriatic Acid. Dub.

Take of Dried Muriate of Soda, Sulphuric Acid, Water, of each six pounds. Add the acid diluted with the water, after it has become cold, to the muriate put it into a glass retort; then distil to dryness. The specific gravity of this acid is to that of distilled water as 1170 to 1000.

The process for procuring this acid in the Pharmacopœias, is different, principally with regard to the proportions of the ingredients. It would require comparative experiments to determine which is the best proportion; it is not improbable, that in the formula of the Edinburgh College, the proportion of acid is too small, chemists having been formerly led into error in cases similar to this, by supposing, that in decomposing a compound salt by an acid, there is no advantage in adding more of the decomposing acid than is necessary to neutralize the quantity of base which the portion of salt operated on contains. We now know, that in cases of this kind, the product is increased by employing more of the decomposing agent than is strictly necessary to neutralize the ingredient with which it combines; and that if this excess be not employed, a portion of the compound operated on is not decomposed. I have accordingly observed, in performing the above process, according to the formula of the Edinburgh College, that a portion of undecomposed muriate of soda exists in the residual mass. The proportion of acid in the Dublin Pharmacopœia, is, on the other hand, probably too large; that of the London is nearer the medium; and from some experiments by Mr Phillips, the product of muriatic acid appears to be greater from it, than from a process given in a former edition, in which a smaller quantity of acid was added. The London College order, however, too large a proportion of water, and hence the acid obtained is too much diluted: its specific gravity is only 1142. The direction, that the sulphuric acid be diluted only with a portion of the water, and that the remaining water be put into the receiver, is proper, both as abridging the distillation, and assisting the condensation of the acid gas. An apparatus, on the construction of Woolfe's, is sometimes employed, but is unnecessary, as a range of two or three receivers, without tubes immersed in the liquid in each, is sufficient. The advantage of diluting the acid with at least a portion of the water, is, that the rapid effervescence and disengagement of gas produced by the action of the concentrated acid on the muriate of soda is prevented, and the process is rendered more manageable: it is much more convenient, however, to pour the acid on the salt in the retort, than to follow the reverse mode, as directed by the London College. The salt which remains in the retort is extracted by pouring water on it when cold, its solution being favoured by the excess of acid. In the large way the distillation is sometimes performed from an iron pot, connected by an earthen head and tube with a range of receivers, the fire being directly applied, and then the concentrated sulphuric acid is poured directly on the muriate of soda, undiluted, to lessen the action on the iron. But the acid prepared in this way, even when the precaution is followed, of coating the inner surface of the pot, is always contaminated with this metal. The yellow colour which the acid usually has, is not always, however, owing to the presence of iron, but is derived sometimes from a little extractive matter adhering to the sea salt, and it is to consume this that the salt is ordered, in the Edinburgh Pharmacopœia, to be exposed to a red heat, an operation which would otherwise be superfluous. The yellow colour may be removed, by distilling the acid a second time from a little muriate of soda. To the test of the strength of the acid from its specific gravity, the London College have added, that a fluidounce of it, diluted with water, ought to dissolve half an ounce of marble. This, Mr Phillips remarks, however, is the degree of power, only when the acid is of the specific gravity of 1.17; when of the strength obtained by the London process, it dissolves or rather decomposes only 204 grains of marble.

The theory of the process in which muriatic acid is obtained, is sufficiently simple. In all cases, where two acids act on one base, this base would be shared between them, in proportions determined by their affinities to it, and their relative quantities. But circumstances may prevent this participation, and cause one of the acids alone to combine with the base, as, for example, the application of a certain temperature, when one is more disposed than the other to assume the elastic form. This happens in the present case. The sulphuric acid exerts an affinity to the soda of the muriate of soda; this weakens the affinity exerted by the soda to the muriatic acid; its tendency to assume the elastic form prevails, and a portion of it is disengaged, and by the application of heat, aided by the quantity of sulphuric acid employed, the decomposition is rendered complete,—or the sulphuric acid combines with the soda, and the muriatic acid is disengaged; it is condensed partly by the water which rises with it in vapour, and partly by the water placed in the receivers.

This acid exists when uncombined in the elastic form, and is incapable of condensation by any cold or pressure hitherto applied to it. But it is rapidly and largely absorbed by water; the water, at a common temperature, and under a mean pressure, condensing 360 times its volume. When of the specific gravity of 1.170, it is supposed to contain 22 of acid, and 78 of water; it emits pungent vapours of muriatic acid gas on exposure to the air, reddens deeply the vegetable colours, tastes extremely sour, erodes immediately vegetable and animal substances, and exerts considerable chemical agencies. The acid, however, not yielding oxygen readily, can oxidate inflammable and metallic substances, only by enabling them, by a resulting affinity, to attract oxygen from the water with which it is combined.

Muriatic acid has not been analysed, those substances which decompose other acids by abstracting oxygen having no effect in producing its decomposition. Its elements therefore must be retained in union by a powerful affinity.

Some important facts have been established, however, with regard to its constitution, and particularly to its chemical relation to water. Muriatic acid gas had been supposed to be the real acid, or at least to contain only a minute proportion of water. Gay Lussac and Thenard have shewn, that it contains water in intimate combination equal to one fourth of its weight. Thus, when the acid gas is transmitted over oxide of lead, it is condensed in combination with the oxide, and a portion of water equal to this quantity is liberated. Or if oxymuriatic acid gas, the substance formed by the combination of muriatic acid and oxygen, be mingled with hydrogen gas, and exposed to light to favour their mutual action, muriatic acid gas is formed, the oxygen of the oxymuriatic acid combining with the hydrogen, and forming water, which remains in combination with the acid in the gaseous form. This water has the most important influence on the chemical relations of the acid, and, in particular, by its affinity to it favours its transition to its insulated state, and is even essential to its existence in that state. No compound, for example, of the real acid with any base, such as dry muriate of potash or of soda, can be decomposed by a dry acid, even when the most powerful heat is applied; but if a little water is introduced, the decomposition takes place with facility, and muriatic acid gas is rapidly disengaged. For the same reason, oxymuriatic acid gas is incapable of decomposition if water be excluded; charcoal, for example, aided by the most intense heat, has no effect upon it. But if water be admitted, even the weak action of solar light is sufficient to expel its oxygen, the muriatic acid receiving that portion of water necessary to its existence in its insulated form. Hence too in all cases of the action of muriatic acid on inflammable or metallic bases, the base receives oxygen from the water present, hydrogen is disengaged, and the oxide formed combines with the real acid. While in the action of oxymuriatic acid on the same bases, its oxygen combines with the base, and the oxidated product in like manner combines with the real acid, forming the same compound.

In these results, muriatic acid displays relations to water, similar to the other powerful acids. They all exert to it a powerful affinity, contain a portion of it in intimate combination, and cannot be obtained free from this combined water in an insulated state. The only peculiarities with regard to muriatic acid, are its not being capable of being decomposed by those processes which effect the decomposition of the other acids, and its combining with oxygen with facility; peculiarities probably arising from the same cause, the powerful affinity of its base to oxygen.

These facts have been explained, however, on a different hypothesis, suggested by Gay Lussac and Thenard, and since supported by Sir H. Davy, that oxymuriatic acid, instead of being a compound of muriatic acid and oxygen, is a simple substance, and that muriatic acid is a compound of it with hydrogen. According to this doctrine, the production of muriatic acid gas, in the mutual action of oxymuriatic gas and hydrogen, is a simple combination. The substances formed by the action of oxymuriatic gas, or chlorine as it has been named, on inflammable or metallic bases, are in like manner compounds of the base and the oxymuriatic principle. The production of the same compounds, by the action of muriatic acid on these bases, is conceived to arise from the decomposition of the acid, its hydrogen being disengaged, and its other element combining with the base. The water deposited when muriatic acid gas acts on metallic oxides is supposed to be formed by the decomposition of the acid, its hydrogen combining with the oxygen of the oxide, and the products, however analogous to metallic salts, are not saline substances, but are supposed to be compounds of the metals with chlorine. The production of oxymuriatic acid by the usual processes is ascribed to the oxygen imparted to the muriatic acid decomposing it, by combining with its hydrogen, forming water, and liberating the chlorine; and the disengagement of oxygen from oxymuriatic acid is supposed to arise from the decomposition of water, the hydrogen of which unites with the chlorine and forms muriatic acid. It would be foreign to the objects of this work to enter on any examination of these opinions. The common doctrine is deduced by the strictest reasoning from the facts, is least complicated, and most conformable to analogy in all its explanations: the opposite opinion rests on no conclusive evidence, and seems in a great measure to have been supported on mistaken views of what constitutes chemical induction.

Muriatic acid is applied to few medicinal purposes. It has been given as a refrigerant and antiseptic in scarlatina, in a dose of 10 or 15 drops occasionally: and to relieve *ardor urinæ* in gonorrhœa. It has also been employed, as has been already stated, as a lithontriptic; and in some cases of calculus, considerable advantage has been derived from it, both in relieving the pain, and diminishing the sediment deposited from the urine, probably in consequence of its solvent power being exerted on the phosphate of ammonia and magnesia, or the phosphate of lime, which are frequently ingredients of urinary calculi. It has been taken in a dose from 20 to 30 drops. From its chemical agency it is employed in various pharmaceutic processes. In the state of gas it has been used to neutralize contagious effluvia, but it is inferior in efficacy to nitric or oxymuriatic acid.

ACIDUM MURIATICUM DILUTUM. Diluted Muriatic Acid. Dub.

Take of Muriatic Acid, Distilled Water, each one pound. Mix them.

This is a formula rather superfluous, as muriatic acid is not employed medicinally, and requires therefore no adjustment to render its exhibition convenient; and for any pharmaceutic process, it is easy to order its dilution to the requisite extent.

AQUA OXYMURIATICA ET AQUA ALKALINA OXYMURIATICA. Oxymuriatic Water, and Alkaline Oxymuriatic Water. Dub.

Take of Muriate of Soda dried, two pounds; Manganese in powder, one pound; Water, Sulphuric Acid, each two pounds. Put the muriate of soda and the manganese mixed together into a matrass, and add the water; then by a convenient apparatus add the sulphuric acid gradually, and at intervals; transmit the gas which is disengaged through a solution of four ounces of sub-carbonate of potash, in twenty-nine ounces of water. Toward the end of the operation, apply a moderate heat to the matrass. The specific gravity of this liquid is to that of distilled water as 1087 to 1000.

The Oxymuriatic Water is prepared by transmitting the superfluous gas of the above process, by a proper apparatus, through a pint of distilled water. The specific gravity of this liquor is to that of distilled water as 1003 to 1000.

When muriate of soda, black oxide of manganese, and sulphuric acid are mingled together, the sulphuric acid combining with the soda disengages the muriatic acid; and the acid, by the action of the oxygen of the oxide of manganese, is converted into oxymuriatic acid, which assumes the elastic form: this change, according to the common doctrine, explained under the preceding process, consisting merely in the combination of the oxygen and the muriatic acid, while, according to the opposite hypothesis, it is owing to the decomposition of the muriatic acid, the hydrogen supposed to be one of its elements combining with the oxygen and forming water, while the chlorine, the other element, is liberated. The process is attended with some difficulty. If the sulphuric acid is concentrated, its action is rather too rapid, and gives rise to a disengagement of gas not easily regulated; and if any part of the elastic product is forced from the apparatus, it is extremely disagreeable to the operator, from its highly suffocating odour. It is proper therefore to use the acid diluted somewhat, and after the commencement of the operation, to favour its progress by the application of a moderate heat. The proportions of the ingredients recommended by Vauquelin, are four parts of muriate of soda, one of oxide of manganese, three of sulphuric acid, and two of water. When the combination of the gas, either with water, or with an alkaline solution, is to be effected, it is proper to use the bottles of Woolfe, so as to transmit the gas through the liquid, the first bottle being left empty to collect a little common muriatic acid that distils over, holding oxide of manganese dissolved.

Oxymuriatic acid exists in the gaseous form, and is distinguished from other elastic fluids by its colour, which is yellowish green. It has an intolerable suffocating odour. Water, at a moderate temperature, absorbs twice its volume of it, forming a liquid of a yellowish colour, having the same odour, and a harsh styptic taste. The acid both in its gaseous and liquid form is distinguished by its power of destroying the vegetable colours.

Oxymuriatic acid has been employed to neutralize the agency of contagion, and change the noxious constitution of foul or corrupted air. To Guyton we are indebted for this application of it. It has been successfully applied in fumigating the wards of hospitals, the apartments of a prison, or other situations in which the atmosphere is contaminated by noxious effluvia, and probably is in this respect the most powerful agent we have it in our power to employ. By its chemical agency, it changes the constitution of the greater number of the compound gases, and more particularly of those having carbon and hydrogen as their elements. Noxious effluvia, derived from the decomposition of vegetable and animal matter, which are the usual sources of a corrupted or contagious atmosphere, may be presumed to be of similar constitution, and therefore to be liable to similar decomposition; and accordingly it has been ascertained, that air highly tainted has its purity, so far as is connected with the removal of such effluvia, restored by the diffusion of the vapours of oxymuriatic acid. The usual materials are mingled together, the sulphuric acid being used in its concentrated state, and they are distributed in different vessels placed in the apartment designed to be fumigated. The gas is slowly disengaged and diffused, and if necessary the disengagement may be hastened by surrounding the vessel with warm sand. The only disadvantage attending the use of this gas is, that from its suffocating odour, the atmosphere in which it is diffused cannot be breathed. In some situations, as in hospitals, where the sick cannot be removed, this renders it necessary to substitute the nitrous acid vapour. But where this does not limit its use, the oxymuriatic acid, as more active, is to be preferred. In its pure state, the oxymuriatic acid is not applied to any other medicinal use, and there is therefore scarcely any necessity for the solution of it in water, which has received a place in the Dublin Pharmacopœia.

The salt obtained by transmitting the oxymuriatic acid gas through a solution of potash, and named the Oxymuriate of Potash, it has already been remarked, has been received into the Materia Medica, and has been employed as an antisyphilitic remedy. This salt is not strictly an oxymuriate, but the compound of an acid containing still more oxygen than the oxymuriatic acid, what has been named the Hyper-oxymuriatic Acid. When the oxymuriatic acid gas is introduced into the alkaline solution sufficiently concentrated, it undergoes a singular decomposition: one portion of it returns to the state of muriatic acid, and combines with part of the alkaline base; the other portion, receiving the oxygen which this had parted with, passes to the state of an acid, having of course a still larger proportion of oxygen in its composition than the oxymuriatic acid has, and this combines with another portion of the alkali. The former salt, the muriate of potash, being abundantly soluble, remains dissolved; the other, being more sparingly soluble, is deposited in crystalline plates. These form the salt named Oxymuriate, but more properly Hyper-oxymuriate of Potash, (Hyper-oxymurias Potassæ.)

These combinations are much influenced by the concentration of the alkaline solution. If it is much diluted, the oxymuriatic acid is absorbed by it, and remains united with the water and the alkali without decomposition; as is evident from the liquor retaining the property of destroying the vegetable colours,—a property belonging to the oxymuriatic acid, but not to the hyper-oxymuriate of potash. It is only when the more powerful action of the alkali on the acid is favoured by concentration, that the decomposition takes place; and Berthollet has supposed, even, that it is much determined by the operation of crystallization itself. The alkaline solution, therefore, into which the oxymuriatic acid gas is transmitted, ought to be of such a strength, that the hyper-oxymuriate will be formed in it, and crystallize spontaneously. The solution ordered by the Dublin College appears to be too weak, and the liquor obtained by their process probably contains much of the oxymuriatic acid undecomposed. A solution of the proper strength is obtained by dissolving sixteen ounces of subcarbonate of potash in four pounds of water; and as the disengagement of the carbonic acid, by the action of the oxymuriatic acid, is troublesome, it is better to remove it by previous agitation of the solution with eight ounces of lime. From this solution, when the transmission of the oxymuriatic acid gas is continued for a sufficient length of time, the hyper-oxymuriate crystallizes spontaneously, and the quantity of crystallized salt ought not to be increased by any evaporation of the liquor, as a portion of muriate of potash might crystallize along with it. The crystals are therefore removed, washed with a little cold water, and dried. And when the salt is to be medicinally used, it ought always to be under this crystallized form. The solution ordered in the Dublin Pharmacopœia must be an uncertain preparation.

Hyper-oxymuriate of potash crystallizes in thin quadrangular tables, white, with considerable lustre. Its taste is cool and penetrating. It dissolves in 17 parts of cold water, and in 5 of boiling water; is fused by heat; and by a higher heat is decomposed, giving out very pure oxygen gas. From the facility with which it parts with oxygen, it acts with much force on inflammable bodies, producing, by mere trituration with them, or percussion, violent deflagrations or detonations.

Its medicinal applications have been already pointed out. When nitric acid was introduced as a remedy in syphilis, the theory which suggested its use, that it operates by communicating oxygen to the system, led to the employment of hyper-oxymuriate of potash, as a more powerful oxygenating remedy. It was given in a dose of ten grains thrice a-day; and from the cases then brought forward, appeared to be superior even to nitric acid in suspending the symptoms of syphilis. It was not however ultimately established in practice; and as no great advantage appears to be derived from it as an auxiliary to mercury, it is now seldom prescribed.

ACIDUM NITROSUM. Nitrous acid. Ed.

Take of Nitrate of Potash bruised, two pounds; Sulphuric Acid, sixteen ounces. The nitrate of potash being put into a glass retort, pour upon it the sulphuric acid, and distil from a sand-bath with a fire gradually raised, until the iron pot is at an obscure red heat. The specific gravity of this acid is to that of distilled water as 1550 to 1000.

ACIDUM NITROSUM. Nitrous Acid. Dub.

Take of Nitrate of Potash, six pounds; Sulphuric Acid, four pounds. Mix and distil to dryness. The specific gravity of this acid is to that of distilled water as 1500 to 1000.

In this process the sulphuric acid combines with the potash, and disengages the nitric acid. The latter acid, however, suffers a partial decomposition during the distillation, principally from the effect of the heat, and partly probably from the relation of the acid to water. Nitric acid retains a considerable quantity of water in intimate combination, and it cannot be obtained without this water in an insulated state. As it exists in nitre, it is partly deprived of this water, and the sulphuric acid employed to disengage it does not appear to be capable of affording that portion of water necessary to preserve the constitution of the nitric acid. When heat is applied, therefore, so as to disengage the latter acid, it is at the same time partially decomposed; it loses a part of its oxygen, and a quantity of nitric oxide gas is formed; this is absorbed by the nitric acid, which is not decomposed, and forms the nitrous acid, which is of a yellow or red colour, more or less so, according as it is more largely impregnated with nitric oxide, and according, therefore, to the degree of heat employed in the distillation. This decomposition takes place principally towards the end of the distillation, when the heat is high, and the water of the materials has been in a great measure volatilized, and the acid, therefore, is of a deeper colour, and more fuming, as the distillation has been continued longer. The residuum is sulphate of potash, with an excess of sulphuric acid, for it is found useful in practice to employ an excess of acid to render the decomposition of the nitre complete. The specific gravity of the acid is stated too high by the Edinburgh College; the coloured, or what is strictly named Nitrous Acid, being not easily procured of a greater specific gravity than 1.52. It sometimes contains minute quantities of sulphuric acid and muriatic acid; the first is detected by adding muriate of barytes to the acid diluted with two parts of distilled water, sulphate of barytes being formed; the other is detected by nitrate of silver, muriate of silver being precipitated. When not intentionally added, however, these acids are never present in sufficient quantity to render it unfit for medicinal or pharmaceutical use.

Nitrous acid is extensively employed as a pharmaceutic agent: from the facility with which it parts with oxygen, it is one of the most important, particularly in oxidating and dissolving the metals. Its powers as a tonic and antisyphilitic remedy have been already considered; though, when it is internally administered, it is necessarily given in the state of nitric acid, being brought to this state by dilution with water. In the state of vapour, it has been employed under the form of fumigation to destroy contagion; the due proportion of nitre and sulphuric acid being mingled together in small earthen cups, which are put in warm sand, and placed in the apartment designed to be fumigated, and, though inferior to oxymuriatic acid in power, it has the advantage that it can be applied without requiring the removal of the sick.

ACIDUM NITRICUM. Nitric Acid. Ed.

Take of Nitrous Acid, any quantity. Put it into a retort, and a receiver being adapted, apply a very gentle heat until the reddest part shall have passed over, and the acid which remains in the retort shall have become nitric acid.

Acidum nitricum. Nitric Acid. Lond.

Take of Nitrate of Potash dried, Sulphuric Acid, each two pounds. Mix them in a glass retort; then distil the nitric acid with the heat of a sand-bath, until red vapours are produced. Lastly, having poured the distilled acid on an ounce of dried nitrate of potash, distil it again in a similar manner. The specific gravity of nitric acid is to that of distilled water as 1500 to 1000. If a piece of marble be put into a fluidounce of it diluted with water, seven drachms ought to be dissolved.

The process given in the Edinburgh Pharmacopœia is that which has been usually followed by chemists to convert nitrous into nitric acid. The nitrous acid is merely the nitric acid holding dissolved a portion of nitric oxide: when heat is applied, the nitric oxide being more disposed than the acid to assume the elastic form, the affinity by which it is retained in combination with it is weakened, and it is disengaged: this affinity, however, so far continues to operate, that the gas carries a portion of the acid along with it, and it escapes therefore in the state of very deep coloured nitrous acid vapour. The process is thus so far attended with loss, but this may be obviated by condensing the nitrous acid vapour, by a portion of water put in the receiver, the diluted acid which will thus be obtained being easily applied to use. The heat ought to be applied by a water-bath, this being sufficiently high to expel the nitric oxide gas, and being not so high as to produce decomposition of the acid.

It is difficult, however, by this method, to render the acid perfectly colourless; the last portion of nitric oxide, communicating a pale straw colour, is retained by such an affinity, and the volatility of the acid in this state approaches so nearly to that of nitric acid, that the whole may be distilled without the oxide being entirely separated. A more perfect process to obtain perfectly colourless nitric acid, is to distil it from a little black oxide of manganese, which yields oxygen to the nitric oxide.

The process of the London Pharmacopœia is of a different kind. From the large quantity of sulphuric acid employed to decompose the nitre, the acid is obtained by the first distillation more nearly in the state of nitric. The operation of this excess of sulphuric acid, in preventing the partial decomposition which would form nitrous acid, probably depends on two circumstances: one, that from the quantity adding to the force of the affinity it exerts to the potash of the nitre, less heat is required to effect the decomposition, and the greater part of the nitric acid is brought over before it is necessary, in continuing the distillation, to raise the temperature so high as to evolve nitric oxide; the other, that the water of this excess of acid will be volatilized, in the progress of the distillation, and contribute to preserve the constitution of the nitric acid in the manner which has been explained under the preceding process. The influence of the latter circumstance is very well shewn by the fact, that the product, instead of being superior in specific gravity to nitrous acid, as concentrated nitric acid is, is inferior, being, as stated in a report made to the College on the products of this process from different proportions of the materials, 1.50, while the nitrous obtained from 6 of nitre and 3 of sulphuric acid, is stated as having been obtained at 1.53. The weight too of the former, from a given quantity of nitre, amounted to four, that of the latter only to three. The relative value of the two is expressed by the quantity of marble they dissolve, that of the nitrous being stated at twenty-one, that of the nitric twenty-nine. This expresses probably, (for they are not stated in a very distinct manner), not the relative strengths of equal weights of the two, but the relative strengths of the entire products from a given weight of nitre; for were the former the meaning, an acid of low specific gravity would be represented as stronger than one of higher specific gravity. It will thus follow, that though a larger quantity of acid is obtained from the materials, by the mode of conducting the process in the London Pharmacopœia, the acid itself is not in its concentrated state. The dryness of the nitre as ordered by the London College is altogether superfluous, and so far indeed as it has any effect counteracts the object of the process, by favouring the decomposition of the nitric acid. The second distillation is likewise unnecessary. The process is so imperfect in affording an acid which is properly nitric, that it ought to be discarded, though it may be economical in affording an acid of inferior strength.

Nitric acid is applied to the same purposes as nitrous acid. Medicinally they must be the same, as the nitrous, by the dilution necessary for its administration, is converted into the nitric. And in their chemical agencies, and therefore in their pharmaceutic applications, they are precisely alike.

ACIDUM NITROSUM DILUTUM. Diluted Nitrous Acid. Ed. Dub.

Take of Nitrous Acid, Water, equal weights. Mix them, avoiding the noxious vapours.—The same proportions are ordered by the Dublin College.

ACIDUM NITRICUM DILUTUM. Diluted Nitric Acid. Lond.

Take of Nitric Acid, a fluidounce; of Distilled Water, nine fluidounces. Mix them.

In combining nitrous acid with water, the greater part of the nitric oxide gas, if it is highly charged with it, is disengaged with effervescence; if less is present, it is retained and converted into nitric acid by the oxygen held loosely dissolved by the water. This, therefore, is diluted nitric acid. It is employed in a number of the chemical processes of the Pharmacopœia, and is convenient, in particular, for the solution of metals, being of that strength at which its action upon them is not too rapid. The diluted nitric acid of the London Pharmacopœia is too weak for this; it can only be intended for internal administration, and as for this purpose it will require still farther dilution, the proportion might be left to be regulated by extemporaneous prescription. The deviation from the proportions in the other Pharmacopœias is therefore without any adequate reason or advantage, and may sometimes lead to dangerous consequences in medical prescriptions.

ACIDUM SULPHURICUM DILUTUM. Diluted Sulphuric Acid. Ed.

Take of Sulphuric Acid, one part; Water, seven parts. Mix them.

ACIDUM SULPHURICUM DILUTUM. Diluted Sulphuric Acid. Dub.

Take of Sulphuric Acid, two ounces; Distilled Water, fourteen ounces. Having mixed them gradually, put aside that they may cool; then pour off the clear liquor. The specific gravity of this acid is to that of distilled water as 1090 to 1000.

ACIDUM SULPHURICUM DILUTUM. Diluted Sulphuric Acid. Lond.

Take of Sulphuric Acid, a fluidounce and a-half; of distilled water, fourteen fluidounces and a-half. Gradually add the Acid to the Water; then mix them.

The intention of this formula is to afford an acid sufficiently dilute to admit of its dose being easily regulated. The London College have, without any necessity, altered the proportions both from those of the other Pharmacopœias, and from those which had formerly been ordered in their own Pharmacopœia: they order a fluidounce and a half of sulphuric acid to be mixed with fourteen fluidounces and a half of distilled water, giving the proportion by weight of one part of acid, to nearly five and a half of water. The reason given for this change is, that "the mixture will be more conveniently made, and its dose more easily apportioned, than that of the former Pharmacopœia." The absurdity of this is obvious. A mixture of sulphuric acid with water is made just as easily in one proportion as in another, and the dose of the diluted acid, whatever may be its strength, is apportioned with equal facility. Nor is it of any importance to have any relation between the dose of the diluted acid and any particular quantity of the concentrated acid, as the acid in the latter state has never been prescribed internally. It is to be regretted, that the strength of a preparation, which for a considerable period has been employed in medical practice, has been thus unnecessarily changed, and changed to such an extent.

The preparation of Sulphuric Acid being carried on on a large scale, for the purposes of commerce, no process is given for it in any of the Pharmacopœias, nor could it be executed in the shops. It is formed by burning sulphur mixed with from one-eighth to one-tenth of nitrate of potash, in large leaden chambers. By the oxygen afforded by the nitre, the sulphur is enabled to burn slowly, though the chamber be closed so as to admit of a very imperfect circulation of air; and the acid formed is principally the sulphuric, while, from the combustion of sulphur in atmospheric air alone, sulphurous acid chiefly is produced. The cause of this appears principally to be, that from the decomposition of the nitric acid of the nitre, nitric oxide gas is evolved, which combines with the oxygen of the atmospheric air, and forms nitrous acid vapour, which, in its turn, yields oxygen to the sulphurous acid formed by the direct combustion of the sulphur. The diffusion of watery vapour too through the chamber probably facilitates the formation of sulphuric acid. The acid vapours are absorbed by water placed in the bottom of the chamber. This liquor, when sufficiently acidulated, is concentrated by evaporation, and afterwards by boiling it in glass retorts, and an acid is obtained thick and oily in its appearance, colourless and transparent, having a specific gravity of 1850. Formerly this acid was procured from the decomposition of sulphate of iron, the green vitriol of commerce, by heat; and hence the origin of the name, Vitriolic Acid, by which it has been known.

Sulphuric acid prepared in this manner is never perfectly pure. It contains a quantity of sulphate of potash, (the acid combining with a portion of the potash of the nitre,) and sometimes a small portion of sulphate of lead, derived from the action of the acid on the lead of the chamber. From these it is in a great measure purified by dilution with water, the diluted acid being incapable of holding them dissolved, and hence one advantage of the dilution. The dose of the diluted is also more manageable than that of the concentrated acid. As an astringent it is taken to the extent of from fifteen to thirty drops, usually in a cupful of water.

### ACIDUM SULPHURICUM AROMATICUM. Aromatic Sulphuric Acid. Ed.

Take of Alkohol, two pounds; Sulphuric Acid, six ounces. Drop the acid gradually into the alkohol. Digest the mixture with a very gentle heat in a close vessel for three days, then add of Bark of Cinnamon bruised, one ounce and a half; of Ginger bruised, one ounce. Digest again in a close vessel for six days; then strain through paper placed in a glass funnel.

The dilution of the acid by the alkohol in the proportions in which they are mixed in this preparation, is such, that little chemical action appears to be exerted during the digestion; an odour somewhat peculiar is acquired, but the acidity is little impaired. The aromatics render it more pleasant, and the preparation may be considered therefore as a grateful one for the exhibition of sulphuric acid. Its dose is thirty drops, given in a cupful of water. It is not unfrequently used in dyspepsia, hæmoptysis, and other diseases in which this acid is employed.

ÆTHER SULPHURICUS. Sulphuric Ether. Ed.

Take of Sulphuric Acid, Alkohol, of each thirty-two ounces. Pour the alkohol into a glass retort, capable of bearing a sudden heat. Then pour on the acid in an uninterrupted stream. Mix them gradually by frequent and gentle agitation; then immediately distil from a sand-bath, previously heated for this purpose, into a receiver kept cool with water or snow. Let the heat be regulated in such a manner that the liquor may be made to boil as soon as possible, and continue to boil until sixteen ounces have distilled over; then remove the retort from the sand. To the distilled liquor add two drachms of potash; then distil again from a high-necked retort, with a very gentle heat, into a receiver kept cool, until ten ounces have passed over. If to the acid remaining in the retort after the first distillation, sixteen ounces of alkohol be added, and the distillation be repeated, ether will again be produced. And this may be often repeated.

ÆTHER SULPHURICUS. Sulphuric Ether. Lond.

Take of Rectified Spirit, Sulphuric Acid, of each a pound and a half. Pour the spirit into a glass retort, and add to it gradually the acid, shaking frequently, and taking care that the heat do not rise higher than 120°, until they are mixed together. Then place the retort cautiously in sand previously heated to 200°, so that the liquor may boil as quickly as possible, and let the ether pass into a tubulated receiver, to which another is adapted kept cool by ice or water. Distil the liquor until a heavier portion begin to pass over, which will be observed beneath the ether at the bottom of the receiver. To the liquor which remains in the retort, add again twelve ounces of Rectified Spirit, so that ether may distil in a similar manner.

ETHER RECTIFICATUS. Rectified Ether. Lond.

Take of Sulphuric Ether, fourteen fluidounces; Fused Potash, half an ounce; Distilled Water, two fluidounces. Dissolve first the potash in the water, add to it the ether, shaking thoroughly, until they are mixed; lastly, distil twelve ounces of rectified ether with a heat of about 120°, from a large retort into a vessel kept cold.

LIQUOR ÆTHEREUS SULPHURICUS. Sulphuric Ethereal Liquor. Dub.

Take of Rectified Vinous Spirit, Sulphuric Acid, of each thirty-two ounces. Pour the spirit heated to 120° into a retort capable of bearing a sudden heat, and pour upon it the acid in a continued stream. Mix them gradually, and distil with a heat sufficiently strong and quickly raised, twenty ounces by measure of liquor into a receiver kept cool. If to the acid remaining in the retort, sixteen ounces of rectified spirit are added, sulphuric ethereal liquor will again be obtained by distillation.

ÆTHER SULPHURICUS. Sulphuric Ether. Dub.

Take of Sulphuric Ethereal Liquor, twenty ounces; Subcarbonate of Potash, dry and in powder, two drachms. Mix them, and distil twelve ounces by measure from a high-necked retort with a very gentle heat into a receiver kept cold. The specific gravity of this liquid is to that of distilled water as 765 to 1000.

The directions in the Pharmacopœias, for conducting this process, are nearly the same. The principal peculiarity in the formula of the London Pharmacopœia, is that of adding the acid gradually to the spirit, agitating the mixture after each addition; but on account of the rise of temperature as the mixture proceeds, this is more difficult than the mode directed by the Edinburgh College, of mixing the whole acid and alkohol at once, and any loss of ethereal vapour from the sudden action produced by the mixture in the latter mode is very trivial. The direction given by the Dublin College, to heat the spirit to 120°, before adding the acid, must render the making the mixture more difficult, and endanger the breaking of the retort from pouring in the dense cold acid.

On mixing equal weights of sulphuric acid and alkohol, a mutual action, marked by an elevation of temperature, and change of colour is produced, and a vapour is disengaged, of a pleasant ethereal smell. On raising the temperature by the application of heat, so as to cause the mixed liquid to boil, ether is formed, and distils over. This continues for a considerable time: towards the end of this stage of the process, the liquid in the retort becomes capable of sustaining a higher temperature, and along with the ether, there is produced a white vapour, which condenses in streaks having an oily appearance, in the neck of the retort, and this increasing, collects in the form of a dense oily-like fluid, named Oil of Wine, or Ethereal Oil, which falls to the bottom of the receiver. A quantity of olefiant gas is at the same time formed, and such a quantity of carbonaceous matter is separated from the alkohol that the liquor becomes of a deep brown colour. If the heat be continued beyond this, there is a sudden and copious production of sulphurous acid gas, which, not escaping easily from the heavy liquor in the retort, causes it to swell up, and if not removed from the fire, it will pass over into the receiver. The principal difficulty, therefore, in conducting the process, is to continue the distillation, so as to obtain the largest produce of ether, without bringing over the liquor from the retort. The rule given in the Edinburgh

Pharmacopœia is to continue it, until the liquid condensed in the receiver is equal to half the quantity of alkohol that had been employed; as when this has been obtained, the formation of ether will have nearly ceased; this however is not very easily ascertained with accuracy: The London College direct the distillation to be continued until the ethereal oil is produced; and if care be taken to guard against the sudden swelling up of the liquor in the retort, this may be done, and rather a larger product obtained. The production of this oil is not however always uniform. The most simple rule is, that whenever the neck of the retort becomes obscured with white vapours, the fire should be withdrawn; and if the materials begin to swell, the retort ought to be raised in the sand. The receiver requires to be kept cool by immersion in water, or causing water to trickle over it, in order to promote the condensation of the ether; and care ought to be taken to avoid approaching a burning body to the apparatus, as accidents have sometimes happened, when the vessels were not closely luted, from the volatility and inflammability of the ethereal vapour.

There is considerable difficulty in establishing the theory of the formation of ether. As the process proceeds, the liquor in the retort assumes a dark colour, and a quantity of carbonaceous matter, somewhat bituminous, is diffused through it; it is likewise found to be considerably diluted with water, and another portion of water distils over with the ether. These changes accompany the formation of the ether, and both must be referred to changes in the composition of the alkohol. The explanation usually given of them proceeded on the assumption, that the acid acts by yielding oxygen, which, combining with the hydrogen of the alkohol, forms water; the balance of affinities being thus broken, part of the carbonaceous matter of the alkohol is likewise separated, and its remaining hydrogen and carbon, with any portion of oxygen it may contain, entering into combination, form the ether. To this theory, however, it was objected by Fourcroy and Vauquelin, that the decomposition of the sulphuric acid is not essential to the formation of ether: it may take place to a certain extent towards the end of the process, when the temperature is high, and the liquor is loaded with carbonaceous matter; but there are no indications of it, they affirm, in the earlier stage, during which principally ether is formed; there is no evolution of sulphurous acid, and if the process be stopt at this stage, it was affirmed by these chemists, that the whole acid is to be found undecomposed, the residual liquid being capable of saturating as much of an alkaline base, as the quantity of sulphuric acid employed would do. This led, therefore, to a different view of the agency of the acid. Instead of communicating oxygen, they supposed it to operate by a disposing, or what may be named a resulting affinity, causing part of the oxygen and hydrogen of the alkohol to combine and form water; then the equilibrium of affinities being subverted, carbonaceous matter is precipitated from the alkohol, and new affinities being exerted, ether is the product of the combination of its remaining elements. The subject, however, notwithstanding the researches of these chemists, is obscure. The fact, with regard to the acid not being decomposed, is not altogether certain; for the non-appearance of sulphurous acid, from which it has been inferred, may be owing to the small quantity evolved being retained in the residual liquid, or combined with some of the products; and the power of the liquor to saturate as much of an alkaline base, as the sulphuric acid used in the process could do, may, should even a portion of the acid be decomposed, be owing to the formation, by oxygenation of the elements of the alkohol, of acetic or oxalic acid, both of which indeed have been said to exist in the residual liquor. The fact, that those acids form ethers most readily from alkohol, which yield oxygen most readily, favours the supposition, that a communication of oxygen from the acid is necessary to the commencement at least of the series of changes.

It is sufficiently proved, however, that the decomposition of the acid is not necessary to any great extent, for the residual liquor is still capable of converting a fresh portion of alkohol into ether; and as this is economical, it is ordered in the Pharmacopœias. And its power of doing so appears to diminish progressively, not so much from exhaustion of the acid, as from its becoming too much diluted with water. This water may have either entirely pre existed in the alkohol; or only partially, and have been in part formed by combination of portions of oxygen and hydrogen; and we have no certain mode of determining which of these is the case. The carbonaceous matter which is precipitated, is obviously derived from the alkohol; and its separation led to the conclusion, that less of this matter must exist in the composition of ether than in that of alkohol; that hydrogen, therefore, predominates in the composition of the former, and to this its greater volatility and levity were ascribed. Both alkohol and ether in burning afford water and carbonic acid, and from the comparative quantities afforded in the combustion of each, Cruickshank inferred that the proportion of carbon to hydrogen is in ether as 5 to 1 nearly, while in alkohol it is as 8 or 9 to 1. The younger Saussure, on the contrary, has inferred, from the products of their detonation with oxygen, that ether contains more carbon and hydrogen than alkohol, and differs from it in having a smaller proportion of oxygen. The expenditure of hydrogen and oxygen, therefore, in the formation of water, during the production of ether, must, according to this result, exceed the proportion of carbonaceous matter which is precipitated. The proportions he assigns are 59 carbon, 22 hydrogen, and 19 oxygen. He found, that in its combustion, when it has been properly rectified, it yields no trace of sulphuric acid,—a proof that neither the acid nor the base of the acid enters into its composition, a circumstance in which it differs from the ethers formed from some of the other acids.

Ether obtained by the first distillation is not pure. It is diluted with a considerable proportion of water, sometimes also it contains alkohol, and very generally a portion of sulphurous acid, which had been evolved towards the end of the distillation. To free it from these is the object of the directions for its rectification, which are nearly the same as given in the different Pharmacopœias, the first product being distilled from potash, in a high-necked retort, with a very gentle heat, the potash detaining the sulphurous acid by the affinity it exerts to it, and rendering the water also less volatile. A portion of water is ordered to be added to the potash and ether in the London Pharmacopœia, which may be useful by attracting the alkohol more effectually: it causes, however, some waste of ether. And as all the Colleges admit of a second distillation from the residual liquor, and a fresh portion of alkohol, directions ought to be given with regard to the rectification of the product of this, for it is considerably weaker than the product of the first distillation. The two products ought to be mingled together, and then rectified. If the unrectified ether be much impregnated with sulphurous acid, from the distillation having been continued longer than usual, it will be useful in the process of rectification to add a little black oxide of manganese, which yielding oxygen to the sulphurous acid, converts it into sulphuric, and abstracts it more effectually than is done by the alkali alone. After the acid has been abstracted, the ether may still have an intermixture of alkohol which has distilled over unchanged. This can only be abstracted by agitation with water, which dissolves it. This ought to be done, therefore, previous to the distillation from the potash; the unrectified ether being agitated with an equal quantity of water, the liquid which floats above the water, when the agitation has ceased, being drawn off, the due proportion of potash being added to it, and the distillation being performed as directed in the Pharmacopœias. The ether is thus obtained in its purest form. In the London and Dublin Pharmacopœias, both the Unrectified and Rectified Ether have a place. The Edinburgh College, with more propriety, admit of no distinction, but name the product when rectified, Sulphuric Ether, and sanction its use only in this state.

Sulphuric Ether in a state of purity has a peculiar odour, strong and diffusive, but not pungent; its taste is warm and penetrating; it is colourless and transparent; its specific gravity is 0.732, and when highly rectified is brought so low as .716; it is therefore one of the lightest known liquids. It is also one of the most volatile; it evaporates rapidly at common temperatures; it boils strongly in vacuo, even below 32, and under the atmospheric pressure at 98°. In evaporating it absorbs much caloric; hence, if dropt on the hand it quickly disappears, producing on the spot a sensation of cold; and this affords a very good test of its purity, the volatility being greater, as it is more highly rectified. It is soluble in alkohol in every proportion; in water it dissolves only in the limited proportion of one part to ten; and this affords another test of its proper preparation, as if more soluble it is diluted either with water or alkohol.

Its medicinal properties have been already considered. It is employed principally as an antispasmodic in asthma, hysteria, singultus, and other morbid affections connected with spasm, being given in a dose from half a drachm to a drachm. And it is sometimes applied externally as a stimulant, or, from the cold attending its evaporation, as a remedy to burns.

ÆTHER SULPHURICUS cum ALKOHOLE. Sulphuric Ether with Alkohol. Ed.

Take of Sulphuric Ether, one part; Alkohol, two parts. Mix them together.

SPIRITUS ÆTHERIS SULPHURICI. Spirit of Sulphuric Ether. Lond.

Take of Sulphuric Ether, half a pint; Rectified Spirit, a pint. Mix them.

A process had formerly a place in the Pharmacopœias, in which sulphuric acid and alkohol were submitted to distillation, more alkohol being employed than the acid could convert into ether. A portion of it, therefore, distilled over unchanged on the first application of the heat, and served to dilute the ether that followed. For this preparation, which had been received into practice under the name of Sweet Spirit of Vitriol, the present has been substituted, but it has no peculiar advantage, and is seldom prescribed.

ÆTHER SULPHURICUS cum ALKOHOLE AROMATICUS. Aromatic Sulphuric Ether with Alkohol. Ed.

This is made from the same aromatics, and in the same manner as the Compound Tincture of Cinnamon, unless that in place of Diluted Alkohol, Sulphuric Ether with alkohol is employed.

SPIRITUS ÆTHERIS AROMATICUS. Aromatic Spirit of Ether. Lond.

Take of Cinnamon Bark bruised, three drachms; Cardamom Seeds in powder, a drachm and a half; Long Pepper in powder, Ginger Root cut, of each a drachm; Spirit of Sulphuric Ether, a pint. Macerate for fourteen days in a glass vessel closed, and strain.

The addition of these aromatics to the sulphuric ether in this formula is of so little importance, that the preparation is scarcely ever used, and from the quantity of ether imbibed by the materials is a very uneconomical one.

OLEUM ÆTHEREUM. Æthereal Oil. Lond.

The liquor remaining after the distillation of sulphuric ether, distil with a very gentle heat, until a black froth swells up; then immediately remove the retort from the fire. To the liquor which remains in the retort, add water, so that the oily part may float upon it. Draw this off, and mix with it lime water, as much as may be sufficient to neutralize the acid which is contained in it, agitating them together. Lastly, withdraw the ethereal oil after it has separated.

LIQUOR ÆTHEREUS OLEOSUS. Oily Ethereal Liquor. Dub.

Take the liquor remaining in the retort after the distillation of sulphuric ether. Distil it with a moderate heat to one half.

The product obtained by these processes is probably the same; it is the substance long known by the name of Oil of Wine: in the first process it is formed, but not distilled over; in the second, it is obtained insulated by distillation, though to conduct this is attended with considerable difficulty, from the re-action of the carbonaceous matter, which has been separated from the alkohol, on the sulphuric acid. The London process, according to Mr Phillips, does not succeed. The nature of this oily substance has not been well determined. It has been considered as a compound of ether and sulphurous acid: it is not proved that by the combination of these it can be formed, but by agitation with potash they are obtained from it, which so far proves that sulphurous acid enters into its composition. Fourcroy and Vauquelin supposed, that it is analogous to ether, differing from it in containing a larger proportion of carbon. It can be formed more directly by distilling ether from sulphuric acid. It is thick, unctuous in appearance, less volatile than ether, and soluble both in it and in alkohol. It is applied directly to no medicinal use, but is employed in forming the following preparation:

SPIRITUS ÆTHERIS COMPOSITUS. Compound Spirit of Ether. Lond.

Take of Spirit of Sulphuric Ether, a pint; Ethereal Oil, two fluidrachms. Mix them.

A composition had been in use under the name of Hoffman's Anodyne Liquor, which consisted of alkohol, with a portion of ether and ethereal oil. This, after having been discarded from the Pharmacopœias, has been restored in the present preparation, on the supposition that it possesses superior powers as an anodyne. It probably differs, however, in nothing from ether with alkohol, at least there is no distinct proof of any peculiarity of operation being communicated by the ethereal oil.

ÆTHER NITROSUS. Nitrous Ether. Dub.

Take of Nitrate of Potash, dried and in coarse powder, one pound and a half; Sulphuric Acid, one pound; Rectified Vinous Spirit, nineteen ounces by measure. Put the nitrate of potash into a tubulated retort, placed in a bath of cold water;

and add to it gradually, and in small quantities, the sulphuric acid and alkohol, previously mixed and allowed to become cold. Without any external heat, or with only such a slight degree of it as may be communicated by the addition of a little tepid water to the bath, an ethereal liquor will begin to distil. In a short time, the heat in the retort will increase spontaneously, and a considerable ebullition will take place, which must be moderated by adding a portion of cold water to the bath. It is necessary also, that the receiver should be kept cold with water or snow, and it ought to be furnished with an apparatus adapted to transmit through a pound of rectified spirit, in a phial kept cold, the highly elastic vapour, disengaged suddenly, and with great force, from the mixture, if the heat is raised rather too high. The ethereal liquor thus obtained by spontaneous distillation is to be put into a phial closely stopt with a glass stopper; and to neutralize the excess of acid, as much sub-carbonate of potash, dry and in powder, is to be added as is necessary, closing the phial after each addition, and determining the neutralization by the test of litmus. This is generally attained on the addition of about a drachm of the salt, and in a short time the nitrous ether rises to the surface, and may be withdrawn by a funnel. To obtain the ether in its purest state, distil it again from a water-bath, heated to about 140° to one half. Its specific gravity is to that of distilled water as 900 to 1000.

The process for preparing nitrous ether has always been found difficult, from the great susceptibility of decomposition of the acid, and the rapidity with which it communicates oxygen to the alkohol. Their mutual action, in consequence of this, becomes extremely violent, and it is difficult to add the requisite proportion of nitric acid to convert it into ether, or to do so at least without considerable waste in the dissipation of elastic products. Different arrangements have been contrived to facilitate this, but probably none that can be conducted more easily than that now received into the Dublin Pharmacopœia, originally contrived by Woulfe, and found by Pelletier to succeed better than any other. The addition of the mixture of sulphuric acid and alkohol should be made in small quantities at a time, not exceeding two ounces, and the quantity of product is increased by keeping the first receiver perfectly cool, and connecting with it not merely one bottle, but a range of bottles, containing, according to a method employed by Thenard, a saturated solution of muriate of soda kept cool by ice, through which the elastic product is transmitted; it is condensed, and the liquid floats on the surface.

The theory of the formation of nitric ether remains obscure; the series of changes, however, are obviously altogether different from those which take place in the production of sulphuric ether. The acid is entirely decomposed, or nearly so, scarcely any trace of it having been found by Pelletier in either the distilled or the residual liquor; there is no precipitation of carbonaceous matter from the alkohol, the liquor remaining transparent, and of a light yellow colour; and it contains oxalic and acetic acids, much diluted with water. Thenard, in his researches on this subject, found, that the elastic fluid disengaged during the process, consists of nitrogen, nitric and nitrous oxide, and carbonic acid gases, holding dissolved ether, and a portion of acid partly nitrous, partly acetic. The nitric ether, which is condensed, has also combined with it nitric and acetic acids; and when these are abstracted, so that it has no sensible acidity, it acquires this merely on keeping, a proof that the elements of these acids exist in its composition. From the products obtained from its decomposition by transmitting it through an ignited tube, he infers, that 100 parts of it consist of 14.49 of nitrogen, 28.65 of carbon, 48.52 of oxygen, and 8.54 of hydrogen. In its formation, much of the oxygen of the acid appears to combine with the hydrogen of the alkohol, forming water; a portion of it unites with part of the carbon, forming carbonic acid, and with portions both of carbon and hydrogen producing acetic acid; a considerable part of the nitrogen of the acid is disengaged in its insulated state, or in the form of nitric and nitrous oxides, and the remaining oxygen and nitrogen combine with the remaining carbon and hydrogen, and form the nitric ether.

Nitric ether is light and highly volatile; its colour is usually yellow, probably, however, from the presence of a portion of free nitric acid surcharged with nitric oxide; its odour is strong and penetrating, though not so fragrant as that of sulphuric ether; when pure and concentrated its volatility is such, that it instantly evaporates when poured from a phial, and boils at 70° under the common atmospheric pressure; it is highly inflammable: with alkohol it combines in every proportion, but in water it is soluble only in limited quantity, requiring, according to Thenard, when pure, 50 parts for its solution.

This ether has scarcely in its pure form been applied to any medicinal use; though it not improbably is possessed of powers analogous to those of sulphuric ether.

SPIRITUS ÆTHERIS NITROSI. Spirit of Nitrous Ether. Ed.

Take of Alkohol, three pounds; Nitrous Acid, one pound. Pour the alkohol into a large phial placed in a vessel full of cold water, and add the acid gradually, agitating them frequently. Close the phial lightly, and set it aside for seven days in a cool place; then distil the liquor with the heat of boiling water into a receiver kept cold with water or snow, as long as any spirit comes over.

SPIRITUS ÆTHERIS NITRICI. Spirit of Nitric Ether. Lond.

Take of Rectified Spirit, two pints; Nitric Acid, three ounces. Add the acid gradually to the spirit, and mix them, taking care that the temperature shall not rise higher than 120°; then with a gentle heat distil twenty-six fluidounces.

SPIRITUS ÆTHEREUS NITROSUS. Nitrous Ethereal Spirit. Dub.

Add to what remains after the distillation of nitrous ether the Rectified Spirit of Wine which had been employed in the process to condense the elastic vapour, and distil with the highest heat of a water-bath to dryness. Mix this distilled liquid with the alkaline solution remaining after the separation of the nitrous ether, and add also as much dry sub-carbonate of potash as shall be sufficient to neutralize the free acid, ascertaining this by the test of litmus. Lastly, distil this with the mean heat of a water-bath while any liquid comes over. The specific gravity of the distilled spirit is to that of distilled water as 880 to 1000.

A preparation similar to that of the Edinburgh Pharmacopœia has long been employed in medicine. It consists probably of nitric ether diluted with alkohol, and contains always a portion of free acid. It is not difficult to add the nitric acid to the alkohol in the proportion of one to three parts, at least from this quantity of acid added with precaution, no violent action results. If heat were applied to this mixture, however, so as to raise it to 212°, a mutual decomposition, attended with the rapid extrication of elastic products, would take place. The heat must therefore be either applied very slowly, or the method ordered by the Edinburgh College must be followed, that of allowing the mixture to stand for some days in a cool place. During this time, a mutual action is exerted between the acid and alkohol; the former is partially decomposed, and the heat required for distillation can be safely applied. That this decomposition takes place is proved by the experiments of Bayen. He digested an ounce of nitrous acid with two ounces of alkohol for five weeks; the liquor then required for its saturation only 134 grains of an alkaline base, while an ounce of the same acid required to saturate it 282 grains of the same base. And when, after digesting the acid and alkohol together, he submitted them to distillation, on mingling the product and the residual liquor, the whole was capable of neutralizing only 32 grains. By this reciprocal action of the acid and alkohol, a portion of nitric ether has been supposed to be formed, which distils over with a considerable portion of unchanged alkohol, and a quantity of free acid. This, however, is not altogether certain. The acid is so much diluted by the large proportion of alkohol, that it does not act on it with the same force; and the product is different in its qualities from nitric ether, being in particular more fragrant. Still it appears, that the series of changes are somewhat similar, the nitric acid being in part decomposed, and oxalic and acetic acids formed. The propriety of the change which has been made by the London College, that of diminishing so much the proportion of nitric acid, though it renders the process more economical, may be questioned, both as less nitric ether must be formed when the proportion of acid is so small, and as a considerable share of the medicinal efficacy of the preparation depends on the free acid.

The formula of the Dublin College must give a preparation considerably different from the others, particularly in containing no free acid. The residual liquor which is ordered to be employed, must contain a portion of nitric acid; and the alkohol which has been employed to condense the elastic fluid of the first distillation, and which is submitted to the action of this residual liquor, probably contains a portion of nitric ether: by the farther action exerted between them, a product will probably be formed somewhat analogous to that obtained by the preceding processes. But by the action of the alkali, to which it is afterwards submitted, its acidity must be removed, and to a certain extent this must modify its medicinal powers. The product of the process which has been longest in use, that of the Edinburgh Pharmacopœia, and the powers of which are sufficiently ascertained, is probably that which ought to be preferred.

Spirit of nitric ether has an odour extremely fragrant; its taste is pungent and acidulous; it is volatile and inflammable, soluble readily both in alkohol and in water. It is employed principally as a grateful refrigerant in inflammatory affections, as a diuretic in dropsy, or rather as an auxiliary to promote the operation of more powerful diuretics, and as a stimulant relieving nausea and flatulence. Its dose is 30 or 40 drops taken in a cupful of water.

CARBONAS POTASSÆ. Carbonate of Potash. Ed.

Let impure Carbonate of Potash be put into a crucible, and exposed to a red heat, that the oily impurities, if any are present, may be burnt out; then having rubbed it with an equal weight of water, mix them thoroughly by agitation. The liquor, after the impurities have subsided, being poured into a clean iron-pot, is to be boiled to dryness, stirring the salt constantly towards the end of the boiling, that it may not adhere to the vessel.

POTASSÆ SUBCARBONAS. Subcarbonate of Potash. Lond.

Take of impure Potash, three pounds; of boiling Water, three pints and a-half. Dissolve the Potash in the Water, and strain; then pour it into a clean iron vessel, and dissipate the water by a gentle heat, so that the liquor may become thick; afterwards having withdrawn the fire, stir it constantly with an iron spatula until the salt pass into small grains. A purer subcarbonate of potash may be prepared in the same manner from tartar, which has been first burnt, until it be of a grey colour.

**SUBCARBONAS KALI.** Subcarbonate of Kali. Dub.

Take of Potashes in coarse powder, Cold Water, of each six pounds. Mix by rubbing them together, and macerate for a week in an open vessel, stirring occasionally; then strain the ley, and evaporate to dryness, in a very clean iron vessel, stirring the saline mass constantly towards the end of the evaporation, with an iron spatula. When reduced in this manner to a coarse powder, let it be kept in close vessels. Before dissolving the Potashes in water, if they are very impure, let them be calcined in a crucible until they become white.

The Potash and Pearl-ash of commerce are obtained by the incineration of the wood of land vegetables; the ashes being lixiviated with water, so as to dissolve the saline matter, and this being evaporated to dryness. The dry mass consists principally of sub-carbonate of potash, with smaller quantities of sulphate and muriate of potash, siliceous earth, and metallic matter, principally oxides of manganese and iron. These are in a great measure abstracted by the above process, the sub-carbonate of potash from its greater solubility being dissolved, while the others, and especially the earthy and metallic matter, from the small quantity of water employed, remain undissolved. It is obtained at least sufficiently pure for medicinal or pharmaceutical use.

This saline matter is in the state of sub-carbonate, and is therefore improperly named carbonate in the Edinburgh Pharmacopœia. It is deliquescent, acrid, changes the vegetable colours to a green, and has the general alkaline properties. It consists, according to Kirwan, of about 60 of potash, 30 of carbonic acid, and 6 of water, with a few grains in 100 of sulphate of potash, siliceous and argillaceous earth. It is seldom applied to any medicinal use, but is employed principally as an agent in Pharmacy.

Carbonas potassæ purissimus, *olim Sal Tartari.* Pure Carbonate of Potash, *formerly Salt of Tartar.* Ed.

Take of impure Super-tartrate of Potash, any quantity. Having wrapped it up in moist bibulous paper, or put it into a crucible, burn it into a black mass, by placing it among live coals. Having reduced it to powder, subject it to a moderate heat, in an open crucible, until it become white, or at least of an ash-grey colour, care being taken that it do not melt. Then dissolve it in warm water; strain the liquor through linen, and evaporate it in a clean iron vessel, stirring the matter constantly, towards the end of the evaporation, with an iron spoon, that it may not adhere to the bottom of the vessel. A very white salt will remain, which is to be left a little longer on the fire, until the bottom of the vessel is nearly at a red heat. When cold, it is to be kept in glass vessels, well stopt.

Kali a tartaro. Kali from Tartar. Dub.

Take of Crystals of Tartar, any quantity. Expose it to a red heat in a silver crucible lightly covered until it cease to emit vapours. Reduce the residual matter into coarse powder, and calcine it in the same crucible without a cover for two hours, stirring it constantly. Then boil it with twice its weight of water for a quarter of an hour, and after sufficient subsidence pour off the pure liquor. Let this be done thrice. Strain the mixed liquors, and evaporate in a silver vessel; bring the residual salt, as it becomes dry, into grains by frequent agitation; then expose it to a low red heat; remove it from the vessel before it is entirely cold; and keep it in phials well stopt.

By exposing super-tartrate of potash to heat, the tartaric acid is decomposed. Part of its carbon and oxygen unite, and form carbonic acid, which is attracted by the potash; and, by continuing the heat, the remaining carbonaceous matter is burnt out. The super-tartrate of potash of commerce usually contains a little tartrate of lime, which by the heat is converted into carbonate of lime; but by dissolving the saline matter in water, this, and any other earthy substances are separated, and, by evaporation, a salt is obtained, which, like the former, is a sub-carbonate of potash, but more pure. It appears also to contain rather a larger proportion of carbonic acid. The process, however, being more expensive than the preceding one, and not being attended with any adequate advantage, the product of it is not often to be found in the shops.

LIQUOR POTASSÆ SUB-CARBONATIS. Liquor of Sub-Carbonate of Potash. Lond.

Take of Sub-Carbonate of Potash, a pound; of Distilled Water, twelve fluidounces. Dissolve the sub-carbonate of potash in the water, and strain through paper.

AQUA SUB-CARBONATIS KALI. Water of Sub-Carbonate of Kali. Dub.

Take of Sub-Carbonate of Kali, any quantity. Put it into an open glass funnel, the throat of which is obstructed with linen. Put this aside in a cellar, that the salt may liquefy in the humid atmosphere. Receive the liquor in a vessel beneath.

The first of these liquors is a solution merely of the sub-carbonate of potash in water; the latter approaches nearer to the state of carbonate, as carbonic acid is absorbed from the air. Both are adapted principally to pharmaceutical use.

CARBONAS POTASSÆ. Carbonate of Potash. Lond.

Take of Sub-Carbonate of Potash, prepared from Tartar, a pound; Carbonate of Ammonia, three ounces; Distilled Water, a pint. Add to the potash dissolved in the water, the carbonate of ammonia; then, by a sand-bath, apply a heat of 180 degrees for three hours, or until the ammonia is expelled, and put the liquor aside that crystals may form. Let the residual liquor be reduced by evaporation, in a similar manner, so that when set aside it may again afford crystals.

The intention of this process is to obtain potash fully saturated with carbonic acid, or in the state of the neutral carbonate, the carbonic acid required for this being abstracted from the ammonia, and the ammonia itself being expelled. The same object is obtained with equal certainty and facility, by transmitting a current of carbonic acid gas through a solution of one part of sub-carbonate of potash, in three parts of water; and the salt obtained from this solution by spontaneous crystallization is probably more pure, as in the former method it is difficult to expel the ammonia entirely. The carbonate crystallizes in quadrangular prisms, which are not deliquescent: they are soluble in four parts of cold water. The taste of this salt is mild, but somewhat alkaline, and it changes the vegetable colours to a green. It is therefore disposed to crystallize with an excess of base, and is, in strictness of chemical language, a sub-carbonate. According to Pelletier, it consists of 40 of potash, 43 of carbonic acid, and 17 of water. It has been introduced as an antacid, in preference to the sub-carbonate, as being milder; and, from the much larger quantity of carbonic acid which it yields, it answers better for preparing the effervescing draught.

AQUA SUPER-CARBONATIS POTASSÆ. Water of Super-Carbonate of Potash. Ed.

Take of Water, ten pounds; Pure Carbonate of Potash, one ounce. Dissolve, and expose the solution to the current of Carbonic Acid Gas, which arises from three ounces of Powder of Carbonate of Lime, three ounces of Sulphuric Acid, and three pounds of Water, gradually and cautiously mixed. The chemical apparatus invented by Dr Nooth is well adapted to this preparation. But, if a larger quantity of the solution is required, the apparatus of Woulfe is preferable. The colder the air is, and the greater the pressure, the better will be the liquor. It ought to be kept in vessels well stopt.

Potash, when used as a lithontriptic, excites so much irritation in the stomach and bladder, that its use cannot well be long continued. But, when super-saturated with carbonic acid, as it is in this preparation, it is rendered more pleasant and less irritating; and, though its lithontriptic or real solvent power is diminished, or perhaps entirely lost, it is capable of acting as a palliative, and of being continued for any length of time; and from the observations already made under the class of lithontriptics, it follows, that no greater benefit is to be expected from the use of alkaline remedies under any form, and that it has even some peculiar advantages. It is taken to the extent of one, or even two pounds in the day. It affords also a grateful antacid. A solution of this kind has been in use for a considerable time; and to establish uniformity in its strength, it is inserted by the Edinburgh College as an officinal preparation. When properly prepared, it is pungent and acidulous, and sparkles when poured into a glass. By employing an apparatus, in which strong mechanical pressure can be applied, the solution may be still more impregnated with carbonic acid: it is thus rendered more grateful, and as an antacid, in particular, is perhaps rendered more effectual, the stimulus of the carbonic acid relieving the uneasy sensations connected with acidity of the stomach, while the alkali neutralizes the acid itself. It is often prepared in the shops with too small a proportion of alkali.

AQUA POTASSÆ, *vulgo Lixivium Causticum.* Water of Potash. Ed.

Take of newly prepared Lime, eight ounces; Carbonate of

Potash, six ounces. Put the lime into an iron or earthen vessel, with twenty-eight ounces of warm water. The ebullition being finished, immediately add the salt; and the whole being well mixed, close the vessel until they become cold. Let the cold materials, previously well agitated, be poured into a glass funnel, the tube of which is obstructed with clean linen. Cover the upper orifice of the funnel, while the neck of it is inserted in another glass vessel, that the water of potash may gradually drop through the linen into the lower vessel. When it first ceases to drop, pour into the funnel a few ounces of water, but cautiously, so that it may swim above the matter. The water of potash will again begin to drop. In this manner the affusion of water is to be repeated, until three pounds have filtered, which will be in the space of two or three days. The upper parts of the liquor are to be mixed with the lower by agitation, and it is to be kept in a vessel well stopt.

LIQUOR POTASSÆ. Liquor of Potash. Lond.

Take of Sub-Carbonate of Potash, newly prepared Lime, each a pound; of Boiling Distilled Water, a gallon. Dissolve the potash in two pints of the water. Add to the lime what remains of the water. Mix the liquors together while hot, then put them into a covered vessel, and after they are cold strain through cotton cloth. If any diluted acid dropt in, excite effervescence, it is necessary to add more lime, and again strain. A pint of this liquor ought to weigh sixteen ounces.

AQUA KALI CAUSTICI. Water of Caustic Kali. Dub.

Take of recently calcined Lime, eight ounces; Sub-Carbonate of Kali, six ounces. Sprinkle on the lime in an earthen vessel, two pints of boiling water, and when slaked mix the salt with it, and close the vessel. Put the mixture as soon as it has cooled into a glass funnel, the throat of which is stopt with linen. The funnel being covered, let the ley drop into a vessel beneath, pouring water on, until three pounds have dropt through. Agitate the liquor and preserve it in a vessel of green glass, well stopt. The ley, if properly prepared, will be free from colour and smell, and will scarcely effervesce when mixed with acids. If there is any sensible effervescence, add to it a little recently calcined lime reduced to a very fine powder; digest for twenty-four hours in a close vessel, agitating occasionally. Lastly, strain the ley in the manner above directed. The specific gravity of this liquor is to that of distilled water as 1100 to 1000.

In this process the lime abstracts the carbonic acid from the potash: it is difficult, however, to abstract it entirely, and hence the necessity for the peculiar arrangement employed, in which a large quantity of lime is used, and in which it is made to act in the most favourable manner by putting the mixture into a funnel, the tube of which is nearly obstructed, so that the alkaline solution must filtrate slowly through the mass of lime. The affinity of the lime to the carbonic acid is thus aided, and the greater part of the acid is abstracted from the potash. Still, however, from the effect of quantity on the force with which affinity is exerted, a small quantity of acid is retained in combination with the potash, which cannot be abstracted by this process. But if the lime has been in a sufficiently active state, and the directions duely observed, so that the filtration has been performed slowly, the quantity is very inconsiderable, as is apparent from scarcely any sensible effervescence being excited by the addition of an acid, and for any medicinal or pharmaceutical purpose to which the solution is applied may be neglected. The agency of the air must be excluded during the filtration, especially from the filtered liquid, to prevent absorption of carbonic acid; and for the same reason it must, after it is prepared, be kept in glass vessels well stopt. The medicinal applications of the alkali under this form have been already considered.

POTASSA, *olim Causticum Commune Acerrimum.* Potash. Ed.

Take of Water of Potash, any quantity. Evaporate it in a covered clean iron vessel, until, when the ebullition is finished, the saline matter flow smoothly like oil, which will happen before the vessel is at a red heat. Then pour it on a clean iron plate; cut it into small masses before it hardens, and immediately put them into a phial well stopt.

POTASSA FUSA. Fused Potash. Lond.

Take of Liquor of Potash, a gallon. Evaporate the water in a clean iron vessel, until the ebullition ceasing, the potash liquefies; then pour it upon an iron plate into proper forms.

KALI CAUSTICUM. Caustic Kali. Dub.

Take of Water of Caustic Kali, any quantity. Evaporate it in a very clean iron vessel, until the ebullition having ceased, the saline matter, on increasing the heat, nearly remains tranquil in the vessel. Pour out this melted salt on an iron plate, and while it is becoming concrete, cut it into proper pieces, which put immediately into a phial well stopt. During the evaporation, the operator should avoid the drops of liquid thrown out from the vessel.

By the dissipation of the water in this process, the alkali is obtained in a solid form, though it still retains a quantity of water in intimate combination: it is usually run into moulds, so as to be formed into cylindrical pieces. Under this form it is used as a caustic; it quickly erodes animal matter, and, mixed with soap into a paste, is sometimes used to open an ulcer.

POTASSA CUM CALCE, *olim Causticum Commune Mitius.* Potash with Lime. Ed.

Take of Water of Potash, any quantity. Evaporate it to one-third in a covered iron vessel; then mix with it as much newly slaked lime as may be sufficient to give it the consistence of a solid paste, which is to be kept in a stopt vessel.

POTASSA CUM CALCE. Potash with Lime. Lond.

Take of the Liquor of Potash, three pints; of newly Prepared Lime, a pound. Boil the liquor of potash to a pint; then add the lime slaked by the water having been poured upon it, and mix them carefully.

**Kali causticum cum calce.** Caustic Potash with Lime. Dub.

Evaporate the Water of Caustic Potash to a third part; then add of recently Calcined Lime reduced to powder, as much as may form a mass of a proper consistence, which is to be kept in a vessel well ſtopt.

As a caustic, this is milder than the former preparation, and it has the advantage of being less deliquescent, so that it can be more easily confined to the part to which it is applied. When mixed, however, with the requisite quantity of soap to form a paste, it is scarcely sufficiently active.

**Acetis potassæ.** Acetite of Potash. Ed.

Take of Pure Carbonate of Potash, one pound. Boil it with a gentle heat in four or five times its weight of Distilled Acetous Acid, and add more acid at different times, until, on the watery part of the former portion being nearly dissipated by evaporation, the acid newly added excite no effervescence: this will happen when about twenty pounds of acid have been consumed. Afterwards evaporate to dryness slowly. Let the remaining impure salt be liquefied with a gentle heat, for a short time; then dissolved in water, and strained through paper. If the liquefaction has been properly done, the strained liquor will be limpid; if not, of a brown colour. Afterwards evaporate with a very gentle heat this liquor, in a shallow glass vessel, stirring the salt while it concretes, that it may more quickly be brought to dryness. Lastly, the acetite of potash ought to be kept in a glass vessel, well closed, that it may not liquefy from the action of the air.

**Potassæ acetas.** Acetate of Potash. Lond.

Take of Sub-carbonate of Potash, a pound and a half; of Acetic

Acid, a gallon. Mix them together in a large glass vessel, and the liquor being evaporated to one half, drop in gradually of acetic acid as much as may be sufficient to full saturation. Let the liquor be again evaporated to a half, and strained; then evaporate in a water bath, so that on being removed from the fire, it may pass into crystals.

ACETAS KALI. Acetate of Potash. Dub.

Take of Sub-carbonate of Potash, any quantity. Add to it at different times of Distilled Vinegar, moderately heated, rather more than five times its weight. When the effervescence has ceased, and the liquor has been partly evaporated, add again at intervals, Distilled Vinegar, until the mixture ceases to effervesce: the evaporation being continued, a dry salt will be produced, which increasing the heat a little, liquefy cautiously. Dissolve it when cold in water, strain the liquor, and boil it down, until when removed from the fire, in cooling it pass into a mass of crystals perfectly white. Put these immediately into phials well stopt.

In this process, the acetic acid of the distilled vinegar combines with the potash, disengaging the carbonic acid. The acetate of potash, obtained by the evaporation, is liable to be of a brownish colour, from the presence, probably, of a little extractive matter, derived from the vinegar. It is freed from this, either by boiling the solution with charcoal powder, or, as directed in the Pharmacopœia, by melting the salt; and, by the second solution and evaporation, it is obtained in the form of a white foliated mass; the foliated structure, which is very characteristic of this salt, arising from a species of crystallization.

Acetate of potash is extremely deliquescent, becoming humid in a very short time from exposure to the air. It does not require so much as half its weight of water for its solution, at the temperature of 60° : it proves moderately laxative, and was at one time celebrated as a diuretic, in a dose of one or two drachms; but it has now nearly fallen into disuse.

SULPHAS POTASSÆ, *olim Tartarum Vitriolatum.* Sulphate of Potash. Ed.

Take of Sulphuric Acid, diluted with six times its weight of Water, any quantity. Put it into a large glass vessel, and gradually drop into it, of Carbonate of Potash, dissolved in six times its weight of water, as much as may be necessary to the perfect saturation of the acid. The effervescence being over, strain the liquor through paper; and, after due evaporation, put it aside, that crystals may form. Sulphate of Potash may also be conveniently made, by dissolving the residuum of the distillation of Nitrous Acid in Warm Water, and saturating it by adding Carbonate of Potash.

POTASSÆ SULPHAS. Sulphate of Potash. Lond.

Take of the Salt which remains after the distillation of Nitric Acid, two pounds; of Boiling Water, two gallons. Mix them, that the salt may be dissolved; then add of sub-carbonate of Potash, as much as will be sufficient to saturate the acid. Afterwards boil it until a pellicle appear on the surface, and when strained, put it aside, that crystals may be formed. Having poured off the water, dry them on bibulous paper.

SULPHAS KALI. Sulphate of Potash. Dub.

Dissolve the Salt which remains after the distillation of Nitrous Acid, reduced to powder, in a sufficient quantity of boiling water; add as much Pearl-ash as may be necessary to saturate the superfluous acid. The liquor being strained, evaporate it with a moderate heat, so that crystals may form.

In the first of the processes of the Edinburgh Pharmacopœia, the sulphuric acid unites with the potash of the carbonate of potash, and expels the carbonic acid with effervescence, the sulphate of potash remaining in solution. The second process, which is that also of the other Pharmacopœias, being more economical, is always followed. The salt remaining after the distillation of nitrous acid is sulphate of potash, with a considerable excess of sulphuric acid: this excess of acid is neutralized by the potash of the carbonate of potash. The neutral salt forms only in small crystals, the figure of which is a four-sided or six-sided prism, acuminated by four or six planes: by slow evaporation they are obtained of a larger size. They require seventeen parts of cold water for their solution. The taste of the salt is bitter. Its powers are those of a cathartic, in the dose of half an ounce; but it is more usually given in smaller doses as an aperient, and, from its sparing solubility, is given usually in powder, and frequently in combination with some of the vegetable purgatives.

SULPHAS POTASSÆ CUM SULPHURE, *olim Sal Polychrestus.* Sulphate of Potash with Sulphur. Ed.

Take of Nitrate of Potash in powder, Sublimed Sulphur, equal weights. Throw them well mixed together, in small quantities at a time, into a red-hot crucible. The deflagration being finished, let the salt cool, and keep it in a glass phial, well stopt.

The nitrate of potash being decomposed at a red heat, affords oxygen to the sulphur, in such proportions as to convert it principally into sulphuric, and partly into sulphurous acids. Both acids are attracted by the potash; and it appears even that from the rapidity of the deflagration, a portion of the sulphur escapes oxygenation, and remains united with a portion of the alkali in the state of sulphuret. This is therefore a mingled product. In its medicinal qualities, it does not appear to differ from the sulphate of potash; and it is soon converted into it, by exposure to the air. Hence it is little used.

Potassæ super-sulphas. Super-Sulphate of Potash. Lond.

Take of the Salt which remains after the distillation of Nitric Acid, two pounds; Boiling Water, four pints. Mix them, so that the salt may be dissolved, and strain. Then boil the solution until a pellicle appear on its surface, and put it aside that crystals may form. The liquor being withdrawn, dry these on bibulous paper.

By solution in water, the free acid of the residual mass is in part removed, but the salt still crystallizes with an excess of acid. It is much more soluble than the neutral sulphate, but it is not apparent to what medicinal use it can be applied, with any peculiar advantage; and it appears liable to variation in its composition, from the extent of evaporation, and other circumstances connected with its formation.

Tartris Potassæ, *olim Tartarum Solubile.* Tartrite of Potash. Ed.

Take of Carbonate of Potash, one pound; Super-Tartrite of Potash, three pounds, or as much as may be necessary; Boiling Water, fifteen pounds. To the carbonate of potash dissolved in the water, add, by small quantities, the Super-Tartrite of Potash rubbed to a fine powder, as long as it excites effervescence, which generally ceases before three times the weight of the carbonate of potash have been thrown in. Then strain the liquor, when cold, through paper; and, after due evaporation, put it aside that crystals may form.

Potassæ tartras. Tartrate of Potash. Lond.

Take of Sub-Carbonate of Potash, a pound; of Super-Tartrate of Potash, three pounds; of Boiling Water, a gallon. Dissolve the sub-carbonate of potash in the water; then add the super-tartrate of potash into powder, until ebullition is no longer excited. Strain the liquor through paper; afterwards boil it until a pellicle appear, and put aside, that crystals may form. Having poured off the liquor, dry them on bibulous paper.

TARTARAS KALI. Tartrate of Potash. Dub.

Take of Sub-Carbonate of Potash, a pound; Crystals of Tartar in fine powder, two pounds and a half, or as much as may be necessary to saturate the potash; Boiling Water, a gallon. To the sub-carbonate of potash dissolved in the water, add the tartar gradually. Evaporate the strained liquor, and put it aside that crystals may form by cooling.

The excess of tartaric acid in the super-tartrate of potash is in this process saturated by the potash of the carbonate of potash, and the proper neutral salt is formed. Though ordered to be crystallized in all the Pharmacopœias, the crystallization of it can scarcely be accomplished by hasty evaporation. In its preparation, therefore, the solution is usually evaporated to dryness, and it is kept in powder in the shops.

This salt has a bitter taste; it is very soluble in water, requiring only four parts of cold water for its solution; and from this greater solubility compared with that of the super-tartrate, it derived its name of Soluble Tartar: it is slightly deliquescent. The portion of alkali producing neutralization is retained by a very weak affinity: even the weaker acids decompose it partially, and reduce it to the state of super-tartrate. As a mild purgative, it is given in the dose of one ounce.

SULPHURETUM POTASSÆ, *olim Hepar Sulphuris.* Sulphuret of Potash. Ed.

Take of Carbonate of Potash, Sublimed Sulphur, of each eight ounces. Having rubbed them together, put them into a large coated crucible; and a cover being adapted to it, apply the fire to it cautiously, until they melt. The crucible, after it has cooled, being broken, remove the sulphuret, and preserve it in a phial well stopt.

**POTASSÆ SULPHURETUM.** Sulphuret of Potash. Lond.

Take of Washed Sulphur, an ounce; of Sub-Carbonate of Potash, five ounces. Rub them together, and put them into a close crucible upon the fire until they unite.

**SULPHURETUM KALI.** Sulphuret of Potash. Dub.

Take of Sub-Carbonate of Potash, Sublimed Sulphur, of each two ounces. Put them mixed together into a crucible, and applying a cover, expose them to a fire gradually raised, until they unite.

During the fusion of the two substances, the sulphur and potash combine, and the carbonic acid is disengaged, only partially, however, and hence the combination is less perfect than when the sulphur is melted with the pure alkali. From the larger proportion of potash, ordered in the formula of the London College, the combination is probably more perfect, and the whole sulphur will be rendered soluble in water. The compound is easily fusible, and is of yellowish green, or brown colour, and inodorous, but becomes fœtid when moistened or dissolved in water from partial decomposition, and the production of a compound of sulphur and hydrogen. It has been proposed to be used as an antidote to some of the metallic poisons, from the supposition that the sulphur will combine with the metallic preparation, and render it inert. From a similar theory, it has been imagined that it might obviate the effects of mercury on the system when these are too violent: but it is very seldom had recourse to with either intention, and it is doubtful if much advantage would be derived from it. The dose in which it has been proposed to be given is from ten to twenty grains, three or four times a-day. It is said, in some cases of cancer, to have increased the efficacy of cicuta as a palliative, in doses of five grains. Externally, it has been recommended in tinea capitis; a wash prepared from three drachms of it with one ounce of soap, dissolved in eight ounces of lime water, with the addition of two drachms of ardent spirit, being applied to the scalp.

AQUA SULPHURETI KALI. Water of Sulphuret of Potash. Dub.

Take of Sublimed Sulphur, half an ounce; of Water of Potash, nine ounces. Boil them together for ten minutes, and filter the liquor through paper. Keep it in phials closely stopt. The specific gravity of this liquor is to that of distilled water as 1120 to 1000.

The alkali in its pure form, and in this state of solution, acts readily on the sulphur and dissolves it, the liquor being of a dark yellow or red colour. It is not merely, however, a solution of sulphuret of potash in water; for whenever sulphur is combined with an alkaline base, it partially decomposes water, and in the state of solution, therefore, a new compound is formed. The nature of their re-action is somewhat complicated. A portion of the sulphur attracts a portion of the oxygen of the water, and the sulphuric acid thus formed is combined with a part of the alkaline base. The hydrogen of the decomposed water enters into union with the remaining sulphur, forming the compound with excess of sulphur, named Super-Sulphuretted Hydrogen, and this remains combined with the rest of the base, forming what some chemists have named a Hydroguretted Sulphuret,—what may be distinguished by the less harsh appellation of a Sulphuretted Hydro-sulphuret. The solution, as prepared by the above formula, is adapted to the same uses as the sulphuret of potash.

CARBONAS SODÆ. Carbonate of Soda. Ed.

Take of Impure Carbonate of Soda, any quantity. Bruise it, and boil it in water until all the saline matter is dissolved. Strain the solution through paper, and evaporate it in an iron vessel, so that on cooling crystals shall form.

SODÆ SUB-CARBONAS. Sub-carbonate of Soda. Lond.

Take of Impure Soda rubbed down, a pound; of Distilled Boiling Water, a gallon. Boil the soda in the water for half an hour, and strain. Evaporate to two pounds, and put aside, that crystals may form. Reject the residual liquor.

CARBONAS SODÆ. Carbonate of Soda. Dub.

Take of Barilla in powder, ten pounds; Water, two gallons. Boil the barilla in the water for two hours in a close vessel, agitating frequently; strain the liquor, and the residuum of the barilla being again rubbed, boil in an equal quantity of water; repeat this a third time. The leys being strained and mixed, are to be evaporated to dryness in an open iron vessel, taking care that the heat is not raised so high as to liquefy the saline matter which remains; stir this with an iron spatula until it become white; lastly, dissolve it in boiling water, and after due evaporation, put it aside, that by slow cooling, crystals may form. These will be purer, if before each boiling the barilla be exposed for some time to the air. The crystals ought to be formed when the temperature of the air is nearly that of freezing water, and the specific gravity of the liquor is to that of distilled water, as 1220 to 1000. If the salt is not sufficiently pure, repeat the solution and crystallization.

The barilla of commerce, from which this salt is ordered to be prepared, is the residual matter of the combustion of marine plants. It is a very impure sub-carbonate of soda, containing large quantities of other saline and earthy matter, chiefly sulphate and muriate of soda, lime, magnesia, argil and silex, with charcoal. The sub-carbonate of soda crystallizing readily, the solution on being evaporated affords it nearly pure in the crystals which first form. The residual liquor, containing more of the other salts, ought to be rejected, a direction properly given in the formula of the London Pharmacopœia. From three to five ounces of the crystallized salt are obtained from a pound of barilla. As the salt has an excess of base, it is improperly named Carbonate by the Edinburgh and Dublin Colleges.

This crystallized salt, though mild to the taste, is sensibly alkaline, and changes the vegetable colours to a green. It crystallizes in octohedrons; its crystals are efflorescent; they require not more than twice their weight of cold water for their solution; and by a heat inferior to that of 212° are liquefied by the action of the very large quantity of water of crystallization they contain. Its quantity amounts to 64 parts in 100, with 21.6 of soda, and 14.4 of carbonic acid. The use of this salt as a lithontriptic has been already stated.

SODÆ SUB-CARBONAS EXSICCATA. Dried Sub-carbonate of Soda. Lond.

Take of Sub-carbonate of Soda, a pound. Submit it to the heat of boiling water in a clean iron vessel until it is perfectly dry, stirring it constantly with an iron spatula. Then rub it into powder.

CARBONAS SODÆ SICCATUM. Dried Carbonate of Soda. Dub.

Liquefy the crystals of Carbonate of Soda in a silver crucible placed on a fire; then increase the heat, and stir the melted salt, until by the evaporation of its water, it become dry. This being rubbed to powder is to be kept in close phials.

Carbonate of soda has been given as a lithontriptic, principally mixed with soap, under the form of pill. If the crystallized salt be used, besides the addition to its bulk from the water of crystallization, it effloresces, so that the pill prepared from it soon loses its cohesion. The dried carbonate is therefore preferable; and from the moderate heat to which it is exposed in the drying, the water merely is expelled, without any farther change in the composition of the salt.

SODÆ CARBONAS. Carbonate of Soda. Lond.

Take of Sub-carbonate of Soda, a pound; Sub-carbonate of Ammonia, three ounces; Distilled Water, a pint. To the sub-carbonate of soda dissolved in the water, add the ammonia; then by a sand-bath apply a heat of 180° for three hours, or until the ammonia is expelled, and put it aside that crystals may form. Let the remaining liquor be evaporated in a similar manner, and put aside that crystals may again be produced.

The sub-carbonate of soda receives in this process carbonic acid from the carbonate of ammonia, and is brought to the neutral state, while the ammonia is expelled by the heat. The quantity of carbonate of ammonia employed is unnecessarily large, and even with this excess, the neutralization of the soda is rather imperfect, being probably counteracted by the heat applied. The neutralization might be effected more directly and economically, by transmitting a current of carbonic acid gas through the solution of the sub-carbonate. The salt in this state is milder than the sub-carbonate: it is therefore more grateful when used as an antacid dissolved in water; and from the larger quantity of carbonic acid it contains, it is also better adapted to the preparation of the effervescing draught.

AQUA SUPER-CARBONATIS SODÆ. Water of Super-carbonate of Soda. Ed.

This is to be prepared from ten pounds of Water, and two ounces of Carbonate of Soda, in the same manner as the Water of Super-carbonate of Potash.

The proportion of the carbonate to the water is greater in this preparation than in that of the super-carbonate of potash water; but this is owing to the carbonate of soda containing so much water of crystallization, that even with the enlarged proportion, there is not more real alkali in the one than in the other. The super-carbonated soda water is used as a lithontriptic in the same dose as the super-carbonated potash water, and is usually preferred, on the supposition of being more pure and mild. It is also in common use as an antacid, applications of it which have been already noticed.

TARTRIS POTASSÆ ET SODÆ, *olim Sal Rupellensis.* Tartrite of Potash and Soda. Ed.

This is prepared from Carbonate of Soda and Super-tartrate of Potash, in the same manner as Tartrate of Potash.

SODA TARTARIZATA. Tartarized Soda. Lond.

Take of Sub-carbonate of Soda, twenty ounces; of Super-tartrate of Potash in powder, two pounds; of Boiling Water, ten pints. Dissolve the sub-carbonate of soda in the water, and gradually add the super-tartrate of potash. Strain the liquor through paper, then boil it, until a pellicle appear, and put aside that crystals may form. Having poured off the water, dry them on bibulous paper.

TARTARAS SODÆ ET KALI. Tartrate of Soda and Potash. Dub.

Take of Carbonate of Soda, twenty ounces; Crystals of Tartar, rubbed to a fine powder, two pounds; Boiling Water, ten pints. To the sub-carbonate of soda dissolved in the water, add gradually the tartar; the liquor being strained through paper, evaporate, and put it aside, that on slow cooling, crystals may form.

The excess of tartaric acid in the super-tartrate of potash, being saturated in this preparation by the soda of the carbonate of soda, a triple salt is formed, properly named Tartrate of Potash and Soda. It crystallizes in rhomboidal prisms; is soluble in five parts of water at 60°, and has a bitter saline taste. It consists, as Vauquelin has stated its composition, of 54 parts of tartrate of potash, and 46 of tartrate of soda. It is employed as a cathartic, in the dose of one ounce, being given dissolved in tepid water, with frequently the addition of manna and of peppermint water, or tincture of cardamom; and is often preferred, as being less disagreeable than the greater number of the saline cathartics.

PHOSPHAS SODÆ. Phosphate of Soda. Ed.

Take of Bones, burnt to whiteness, and reduced to powder, ten pounds; Sulphuric Acid, six pounds; Water, nine pounds. Mix the powder in an earthen vessel with the sulphuric acid; then add the water, and again mix them. Keep the vessel in the vapour arising from boiling water for three days; at the end of which, dilute the matter, by adding other nine pounds of Boiling Water, and strain through a strong linen-cloth, pouring over it gradually, boiling water, until the whole acid is washed out. Put aside the strained liquor, that the impurities may subside, from which pour it off, and, by evaporation, reduce it to nine pounds. To this liquor, again poured off from the impurities, and heated in an earthen vessel, add Carbonate of Soda dissolved in warm water, until the effervescence cease. Then strain, and put it aside that crystals may form. These being removed, add, if necessary, to the liquor, a little Carbonate of Soda, that the phosphoric acid may be exactly saturated; and prepare it, by evaporation, again to form crystals, as long as these can be produced. Lastly, let the crystals be kept in a vessel well stopt.

PHOSPHAS SODÆ. Phosphate of Soda. Dub.

Take of Burnt Bones beat to powder, five pounds; Sulphuric Acid, three pounds and a half. Mix the powder with the sulphuric acid in an earthen vessel; add gradually five pints of water, and stir the mixture. Digest for three days, adding occasionally more water, lest the matter become dry, and continue the stirring; then pour upon it five pints of boiling water, and strain through a linen cloth, pouring on boiling water repeatedly, until the acid is entirely washed out. Put aside the liquor that the impurities may subside, then pour it off pure, and reduce it by evaporation to one half. Lastly, add carbonate of soda, (dissolved in a sufficient quantity of warm water), three pounds and ten ounces; strain, and by repeated evaporation and cooling, form crystals, which are to be kept in a vessel well stopt. If the salt is not sufficiently pure, repeat the solution and crystallization.

The white residuum of burnt bones consists chiefly of phosphate of lime. The sulphuric acid partially decomposes it, by combining with the lime; the phosphoric acid which is disengaged, in conformity to the law of chemical attraction, that quantity of matter influences affinity, and that in all cases where two acids act on a base, there is a participation of this base between them, in proportions determined by their respective quantities and affinities, retains a quantity of lime combined with it, forming a soluble compound. When carbonate of soda is added to the acidulous liquor obtained by washing the materials, the soda combines with the free phosphoric acid, and the lime retaining as much phosphoric acid in combination as forms neutral phosphate of lime, is precipitated; the phosphate of soda crystallizes on evaporation of the strained liquor. Its crystals are rhomboidal prisms, and are obtained of a regular figure only in crystallizing with a slight excess of alkali. Hence the liquor should be slightly alkaline; and from the tendency of the salt to crystallize with an excess of base, it is necessary, though the neutralization may have been perfect, to add, previous to the second crystallization, a little carbonate of soda, as directed in the formula of the Edinburgh Pharmacopœia. The crystals are efflorescent; they are soluble in little more than three parts of cold, and in half that quantity of boiling water. They consist, according to Thenard, of 19 of soda, 15 of acid, and 66 of water. The taste of this salt is purely saline, without any bitterness; its medicinal operation is that of a mild cathartic, and, from being less nauseous to the taste than the other salts, it is entitled to preference. Its dose is one ounce, given generally dissolved in six ounces of tepid water, with the addition of a little peppermint, or any other grateful aromatic.

Sulphas sodæ, *olim Sal Glauberi.* Sulphate of Soda. Ed.

Dissolve the Acidulous Salt, which remains after the distillation of muriatic acid, in Water; and add to it, Carbonate of Lime in powder, to remove the superfluous acid. Put it aside until the impurities have subsided; then having poured off the liquor, and strained it through paper, reduce it by evaporation, that crystals may be formed.

Sulphas sodæ. Sulphate of Soda. Lond.

Take of the Salt which remains after the distillation of Muriatic Acid, two pounds; of Boiling Water, two pints and a half. Dissolve the salt in the water; then add gradually of Sub-carbonate of Soda, as much as will be sufficient to saturate the acid. Boil until a pellicle appear, and when the liquor is strained, put it aside, that crystals may form. Having poured off the water, dry them on bibulous paper.

Sulphas sodæ. Sulphate of Soda. Dub.

Dissolve the Salt which remains after the distillation of muriatic acid in a sufficient quantity of boiling water. Put aside the strained liquor after due evaporation, that crystals may form by slow cooling.

In the decomposition of muriate of soda by sulphuric acid, to prepare muriatic acid, more sulphuric acid is used than is necessary merely to saturate the soda, advantage being gained from its quantity adding to its affinity, as has been already explained; hence the necessity of removing the excess of acid in the residual mass, to obtain the neutral sulphate. In the Edinburgh Pharmacopœia, this is ordered to be done by carbonate of lime. The London College order the excess of acid to be neutralized by carbonate of soda, on the supposition of its being more economical, as increasing the quantity of salt, but from the price of the soda it is less so. Slaked lime is preferable to either, as it decomposes a little muriate of iron, which adheres to the salt. This salt is also obtained as a residuum in some other processes, particularly in the preparation on a large scale of muriate of ammonia, the Sal Ammoniac of commerce. It crystallizes in hexaedral prisms; they are efflorescent and soluble in rather less than three parts of cold water. They consist of 18.48 of soda, 23.52 of acid, and 58 of water. Sulphate of soda has long been in use as a cathartic: it operates with sufficient power and certainty, but is liable to occasion nausea, from its very bitter taste. Its medium dose is an ounce and a half.

MURIAS SODÆ SICCATUM. Dried Muriate of Soda. Dub.

Take of Muriate of Soda, any quantity. Calcine it over the fire in an iron vessel, lightly covered, until it cease to decrepitate, stirring it occasionally.

This is designed merely to prepare the muriate of soda for the process of the distillation of muriatic acid, as already noticed.

CARBONAS AMMONIÆ, *olim Ammonia Præparata.* Carbonate of Ammonia. Ed.

Take of Muriate of Ammonia, one pound; Carbonate of Lime, commonly called Chalk, dried, two pounds. Each being separately reduced to powder, mix them, and sublime from a retort into a receiver kept cold.

AMMONIÆ CARBONAS. Carbonate of Ammonia. Lond.

Take of Muriate of Ammonia, a pound; of Prepared Chalk dried, two pounds. Rub them separately to powder, then mix, and sublime with a heat gradually increased, until the retort is red.

CARBONAS AMMONIÆ. Carbonate of Ammonia. Dub.

Take of Muriate of Ammonia, reduced to powder and well dried, Carbonate of Soda dried, of each half a pound. Put them mixed together into an earthen retort, and sublime with a heat gradually raised into a receiver kept cold.

In this process, as given in the two first formulas, the muriatic acid of the muriate of ammonia combines with the lime of the carbonate of lime, and the carbonic acid of the latter unites with the ammonia of the former; the exertion of these new affinities being determined by the heat applied. The carbonate of ammonia which is formed is sublimed, and is obtained in a crystalline cake. When the process is carried on in the large way, the sublimation is generally performed from an iron pot, to which the heat is directly applied, and which is connected with a large earthen or leaden receiver. The Dublin College, in place of carbonate of lime, order carbonate of soda; with this the application of so high a heat will not be required; but not being sufficiently economical, the direction will not be attended to by the practical chemist. The proportion of carbonate of lime ordered by the other two Colleges, is probably too large, and the excess by adding to the mass of materials, adds to the expence of the vessels and fuel.

According to the experiments of Davy, carbonate of ammonia varies in the proportions of its ingredients according to the heat applied in its preparation; they vary so much as from 20 to 50 parts of ammonia in 100, the ammonia being in larger proportion, as the temperature at which the carbonate has been formed is high; that formed at a temperature of 300° containing 50 parts of alkali, while that produced at a temperature of 60° contains only 20 parts. Still in all these proportions the product is a sub-carbonate; it is not, therefore, properly named in the Pharmacopœias; its smell is pungent and ammoniacal, and it changes the vegetable colours to a green: It is very volatile, abundantly soluble in water, and is efflorescent on exposure to the air. Its medicinal uses are as a stimulant applied to the nostrils in fainting, and as a stimulant and diaphoretic, taken internally, in a dose of from five to fifteen grains. It has been employed with some advantage too in scrofula, combined with bitters.

AQUA CARBONATIS AMMONIÆ, *olim Aqua Ammoniæ*. Water of Carbonate of Ammonia. Ed.

Take of Muriate of Ammonia, Carbonate of Potash, of each sixteen ounces; Water, two pounds. To the salts, mixed and put into a glass retort, add the water; then distil from a sand-bath, with a fire gradually raised, to dryness.

LIQUOR AMMONIÆ CARBONATIS. Liquor of the Carbonate of Ammonia. Lond.

Take of Carbonate of Ammonia, eight ounces; of Distilled Water, a pint. Dissolve the carbonate of ammonia in the water, and strain through paper.

AQUA CARBONATIS AMMONIÆ. Water of Carbonate of Ammonia. Dub.

Take of Muriate of Ammonia, a pound; Carbonate of Soda, twenty-eight ounces; Water, three pints. Distil two pints with a fire gradually raised.

In this preparation of carbonate of ammonia the humid way, carbonate of lime, from its insolubility, could not be employed to decompose the muriate of ammonia, as it is in the dry way; an alkaline carbonate is therefore employed. The alkali, whether potash or soda, attracts the muriatic acid, while the ammonia combines with the carbonic acid. The carbonate, or rather sub-carbonate of ammonia is volatilized and dissolved by the watery vapour. From the substitution of carbonate of soda, for that of potash by the Dublin College, a larger quantity of carbonic acid will probably be combined with the ammonia.

In the formula given by the London College, the proportion of the solid carbonate of ammonia to the water is too large. According to Mr Phillips, the water at 60° dissolves only about one-fourth of its weight.

The water of carbonate of ammonia is applied to the same medicinal purposes as the concrete carbonate, and as being more convenient is generally prescribed for internal use.

LIQUOR VOLATILIS CORNU CERVINI. Volatile Liquor of Hartshorn. Dub.

Take of Hartshorn, any quantity. Put it into a retort, and distil, with a heat gradually raised, a volatile liquor, salt, and oil. Distil the volatile liquor repeatedly until it become limpid as water, separating, after each distillation, the salt and oil by filtration. The liquor will be purified more easily, if, after each distillation except the first, there be added to it a sixth part of its weight of charcoal, previously made red hot, extinguished by being covered with sand, and reduced to powder while hot. If hartshorn cannot be procured in sufficient quantity, the bones of any land animals may supply its place.

This is a process which has long been employed in Pharmacy. The animal matter, principally the gelatin of the bones, at an elevated temperature suffers decomposition, and its principles enter into new combinations, forming chiefly carbonate of ammonia and empyreumatic oil. The carbonate of ammonia is partly dissolved by the water which distils over, and obtained partly in a concrete state. It is always contaminated, however, with the empyreumatic oil, which renders it nauseous; and though at one time it was supposed, from this impregnation, to be possessed of some peculiar virtues, this probably had no just foundation, and it is now rejected from practice. If sublimed from charcoal powder, the oily matter is completely removed; but then it differs in nothing from the carbonate of ammonia obtained by the preceding processes, and the process, with these repeated operations, is not more economical.

Aqua ammoniæ, *olim Aqua Ammoniæ Causticæ.* Water of Ammonia. Ed.

Take of Muriate of Ammonia, one pound; Lime, recently prepared, a pound and a half; Distilled Water, one pound; Water, nine ounces. Pour the water upon the lime bruised in an iron or earthen vessel, closing the vessel until the lime, having fallen into powder, has become cold; then mix the muriate, beat to a very fine powder, with the lime, rubbing them together in a mortar, and then put them into a retort of the coarser glass, *(bottle glass).* Let the retort be placed in a sand-bath, and connect with it properly the apparatus of Woulfe. In the first bottle, of smaller size than the others, furnished with a tube of safety, put two ounces of distilled water; and in the second vessel what remains of the distilled water. Then apply the fire, increasing gradually until the bottom of the iron pot is at a red heat, and as long as the ammonia is produced. Mix the liquor from both bottles, and let it be kept in small phials well stopt.

LIQUOR AMMONIÆ. Liquor of Ammonia. Lond.

Take of Muriate of Ammonia, newly prepared Lime, each two pounds; of Water, a pint and a half. Rub the muriate of ammonia and the lime separately to powder; then mix, and put them into a large glass retort, into which a pint of water has been previously put. To the retort placed in a sand-bath adapt a tubulated receiver, through which the ammonia may pass into a third vessel kept cold, containing eight fluidounces of water. Then apply heat at first gentle, and increase it gradually until the retort is red.

AQUA AMMONIÆ CAUSTICÆ. Water of Caustic Ammonia. Dub.

Take of Muriate of Ammonia, sixteen ounces; recently Calcined Lime, two pounds; Water, six pints. Sprinkle on the lime, put into an earthen vessel, a pound of water, and close the vessel. After twenty-four hours, mix the salt with the lime now fallen into powder, avoiding the vapours; then put the mixture into a retort, and pour upon it the rest of the water. After agitation, distil with a moderate heat, into a receiver kept cold, twenty ounces by measure of liquor, having secured well the joinings of the vessels by lute. The specific gravity of this liquor is to that of distilled water as 936 to 1000.

In these processes, the lime combines with the muriatic acid of the muriate of ammonia, and the ammonia is disengaged. Being permanently elastic, it is condensed only by combination with the water, and this is effected either by distilling water at the same time from the materials, or by transmitting the ammoniacal gas through water. The Edinburgh and London Colleges have preferred the latter mode, and they obtain a solution in this way, perhaps more strongly impregnated; the other is rather more easily conducted, and affords a product sufficiently strong for any medicinal or pharmaceutical purpose. In the mode directed by the London College, there are the obvious objections, that the lime being slaked in the retort, there must be the risk of the glass breaking from the sudden and unequal heat; the ammoniacal gas is also rapidly disengaged, to the annoyance of the operator; the quantity of water is not sufficient for its condensation, and the solution that is obtained is much stronger than that to which practitioners have been accustomed. The College have neglected too to adapt this increased strength to the other officinal preparations into which it enters, so as to preserve them nearly of their former powers. Hence they are now much more pungent and acrid.

When this process is conducted on a large scale, an iron still is employed, into which the materials are put, and to which the fire can be directly applied; the head of the still being connected with a spiral tube placed in a refrigeratory, to the extremity of which, besides the recipient to collect the condensed product, two or three receivers are adapted, containing water to absorb any ammoniacal gas. A modification of this apparatus might be advantageously used on a small scale, at least it would be economical to expose the dry mixture of the muriate and the lime to heat in an iron bottle, and condense the ammoniacal gas by receiving it in water.

Water, under a common atmospheric pressure, and at a temperature below 50°, absorbs about one-third of its weight of gas; and by this combination its specific gravity is diminished, that of the saturated solution being not more than 9054. It is seldom so completely impregnated. By the mode directed by the Dublin College, which is that usually followed, the solution is obtained of the specific gravity of 936; and when of this strength, it contains about 16 of ammonia in 100 parts. Its smell is strong and pungent; its taste extremely acrid, and it inflames the skin. Though its odour is pungent, it ought to be free from any fœtor. It is employed in medicine as a stimulant and diaphoretic, internally, in a dose from twenty to thirty drops, and sometimes as an emetic in a larger dose diluted with water. Externally it is used as a stimulant applied to the nostrils, and as a rubefacient; with the latter intention it is applied mixed with oil, or with soap liniment.

ALKOHOL AMMONIATUM, *olim Spiritus Ammoniæ.* Ammoniated Alkohol. Ed.

Take of Alkohol, thirty-two ounces; recently prepared Lime, twelve ounces; Muriate of Ammonia, eight ounces; Water, eight ounces. From these, prepare the Ammoniated Alkohol in the same manner as the water of ammonia, and preserve it in a similar manner.

SPIRITUS AMMONIÆ. Spirit of Ammonia. Dub.

Take of Proof-spirit, three pints; Muriate of Ammonia, four ounces; Pearl-ash, six ounces. Mix and distil two pints with a moderate heat.

SPIRITUS AMMONIÆ. Spirit of Ammonia. Lond.

Take of Rectified Spirit, two pints; Liquor of Ammonia, one pint. Mix.

In the process of the Edinburgh Pharmacopœia, the lime combining with the muriatic acid of the muriate, disengages the ammonia which is condensed by the alkohol. In that of the Dublin Pharmacopœia, which had also a place in the former edition of the Edinburgh, the decomposition is produced by the sub-carbonate of potash. A sub-carbonate of ammonia is thus disengaged with a considerable excess of ammonia: in this state it is dissolved by the alkohol, especially as the distillation is continued until a spirit weaker than alkohol is distilled over; and the more watery portion of this, towards the end of the distillation, dissolves a portion of sub-carbonate of ammonia, which at that stage of the process condenses in a concrete form on the sides of the receiver. In the preparation according to the formula of the London College, the spirit is also considerably diluted. The water of ammonia, however, of the present edition of the London Pharmacopœia, is so strong from the mode of preparing it, that the ammoniacal impregnation is much stronger than before,—the product containing, according to Mr Phillips, three times the quantity of ammonia that it formerly did; and hence it is too pungent and acrid for use, unless the dose be proportionally diminished. There is another circumstance which may render it doubtful, whether the alteration by the Edinburgh and London Colleges is an improvement,—that when the spirit is impregnated with pure ammonia, the ammonia from its volatility is liable to escape, especially when the impregnated spirit is employed to form tinctures, which in the shops are often kept for a long time, and in bottles not perfectly closed. When the ammonia is in the state of sub-carbonate, this inconvenience is in some measure avoided, and the preparation is also less acrid. Mr Phillips has proposed a process for obtaining this impregnation, more economical than the old process, distilling alkohol from the common sub-carbonate of ammonia with the addition of a little water; a portion of carbonic acid appears to be expelled by the heat, and the ammonia retains only so much as to be still soluble in the alkohol. It might be more economical, and afford a product rather more strongly impregnated, to distil the alkohol from the sub-carbonate of ammonia, with the addition of a little water of pure ammonia. If the object be however to obtain alkohol impregnated with pure ammonia, the process of the Edinburgh or London Pharmacopœia is to be employed.

Ammoniated alkohol has the pungent smell, and retains all the powers of ammonia. It is used principally as the menstruum of some vegetables with which ammonia coincides in medicinal operation.

ALKOHOL AMMONIATUM AROMATICUM, *olim Spiritus Ammoniæ Aromaticus*. Aromatic Ammoniated Alkohol. Ed.

Take of Ammoniated Alkohol, eight ounces; Volatile Oil of Rosemary, one drachm and a half; Volatile Oil of Lemons, one drachm. Mix them so as to dissolve the oils.

SPIRITUS AMMONIÆ AROMATICUS. Aromatic Spirit of Ammonia. Lond.

Take of Spirit of Ammonia, two pints; Oil of Lemons, Oil of Cloves, of each two fluidounces. Mix.

SPIRITUS AMMONIÆ AROMATICUS. Aromatic Spirit of Ammonia. Dub.

Take of Spirit of Ammonia, two pints; Oil of Lemons, two drachms; Nutmegs bruised, half an ounce. Digest in a close vessel, for three days, shaking occasionally; then distil a pound and a-half.

By this combination of ammonia with alkohol, and the addition of the aromatic oils, it is rendered more grateful than the water of ammonia. This preparation is therefore frequently used in preference to the other, as a stimulant in languor or faintness, or to relieve flatulence, and sometimes as an antacid. Its dose is from fifteen to thirty drops.

ALKOHOL AMMONIATUM FŒTIDUM, *olim Spiritus Ammoniæ Fœtidus*. Fœtid Ammoniated Alkohol. Ed.

Take of Ammoniated Alkohol, eight ounces; Assafœtida, half an ounce. Let them digest in a close vessel for twelve hours; then distil eight ounces by the heat of boiling water.

SPIRITUS AMMONIÆ FŒTIDUS. Fœtid Spirit of Ammonia. Lond.

Take of Spirit of Ammonia, two pints; Assafœtida, two ounces. Macerate for twelve hours; then distil a pint and a-half with a gentle heat, into a receiver kept close.

Spiritus ammoniæ fœtidus. Fœtid Spirit of Ammonia. Dub.

Take of Spirit of Ammonia, two pints; Assafœtida, an ounce and a quarter. Digest in a close vessel for three days, agitating occasionally; then pour off the pure liquor, and distil a pint and a-half.

The impregnation of the ammoniated alkohol with part of the assafœtida in this process, though it may communicate a fœtid smell, can add little to its activity; and accordingly, though it has a place in all the Pharmacopœias, it is not found in the shops. It has been given in hysteria in a dose of thirty drops.

Spiritus ammoniæ succinatus. *Lond.* Succinated Spirit of Ammonia.

Take of Mastich, three drachms; Alkohol, nine fluidrachms; Oil of Lavender, fourteen minims; Oil of Amber, four minims; Water of Ammonia, ten fluidounces. Macerate the mastich in the alkohol, so that it may be dissolved, and pour off the clear solution; add to this the other ingredients, and mix them all by agitation.

Spirit of ammonia, impregnated with oil of amber and some other essential oils, has been in use as a stimulating perfume under the name of Eau de Luce. A composition had been introduced into the London Pharmacopœia as a substitute for this, which had not, however, its usual milky appearance. This is given in the present formula by the addition of the mastich, the resinous matter of which is separated by the water, but retained in a state of suspension, probably by the action of the alkali.

Aqua acetitis ammoniæ, *vulgo Spiritus Mindereri.* Water of Acetate of Ammonia. Ed.

Take of Carbonate of Ammonia, any quantity. Pour upon it as much distilled acetous acid, as may be sufficient to saturate the ammonia exactly.

Liquor ammoniæ acetatis. Liquor of Acetate of Ammonia. Lond.

Take of Carbonate of Ammonia, two ounces; of Distilled Vinegar, four pints. Add the Acid to the Carbonate of Ammonia, until effervescence is no longer excited, and mix them.

Aqua acetatis ammoniæ. Water of Acetate of Ammonia. Dub.

Take of Carbonate of Ammonia, two ounces; add gradually, agitating occasionally, of Distilled Acetic Acid, three pounds and a-half, or as much as may be necessary to saturate the ammonia; ascertaining this by the test of litmus.

The acetic acid of the distilled vinegar combines with the ammonia of the carbonate of ammonia, disengaging the carbonic acid with effervescence; and the acetate of ammonia being a very soluble salt, remains dissolved in the water. As the distilled vinegar is not uniform in strength, the precise proportion necessary to be added cannot be assigned, but in general it will be about thirty parts to one. As much must always be added as to produce neutralization; and as the liquid is sometimes used as an external application in cases where the acrimony of the alkali would be hurtful, it is better that there should be even a slight excess of acid. From the variable quantity of acid in the vinegar, the preparation cannot be of uniform strength, and this cannot be obviated by crystallizing the salt, the heat decomposing it which would be necessary to evaporate the water. Were it of any importance, a uniformity of strength might be obtained by ordering the quantity prepared from a given weight of carbonate of ammonia to be reduced by slow evaporation to a certain measure; but this is not necessary, the solution having no great activity, and being given generally in divided doses. It is employed as a diaphoretic in febrile affections, an ounce of it being given, and repeated twice or thrice at intervals of an hour, and its operation promoted by mild diluents. Externally it is sometimes used as a discutient, and as an application in some forms of inflammation.

HYDRO-SULPHURETUM AMMONIÆ. Hydro-Sulphuret of Ammonia. Ed.

Take of Water of Ammonia, four ounces. Expose it in a chemical apparatus to the stream of gas which arises from Sulphuret of Iron, four ounces; Muriatic Acid, eight ounces, previously diluted with two pounds and a half of water. The sulphuret of iron for this purpose is conveniently prepared from three parts of Purified Iron-filings, and one part of Sublimed Sulphur, mixed together, and exposed in a covered crucible, to a moderate heat, until they unite.

HYDRO-SULPHURETUM AMMONIÆ. Hydro-Sulphuret of Ammonia. Dub.

Take of Sulphuret of Iron (prepared by exposing three parts of iron-filings, and one of sulphur, to heat in a covered crucible, until they unite,) in coarse powder, four ounces; Muriatic Acid, seven ounces by measure; Water, two pints; Water of Caustic Ammonia, four ounces. Put the sulphuret into a matrass, then add gradually the acid previously diluted with the water, and transmit the gas disengaged, by an apparatus properly adapted through the water of ammonia. Towards the end of the process, apply to the matrass a moderate heat.

The sulphuretted hydrogen is produced in this process by the muriatic acid enabling the iron to decompose part of the water by attracting its oxygen. The hydrogen disgaged combines with a portion of the sulphur, and forms sulphuretted hydrogen; and this elastic fluid being transmitted through the water of ammonia unites with it, and forms a liquid of a dark green colour, and a very fœtid odour.

The medicinal applications of hydro-sulphuret of ammonia have been already taken notice of. It depresses the action of the stomach and digestive organs, and has been used from this quality in bulimia and in diabetes, in a dose of from five to ten drops twice a-day.

AQUA SULPHURETI AMMONIÆ. Water of Sulphuret of Ammonia. Dub.

Take of recently prepared Lime, Muriate of Ammonia in powder, each four ounces; of Sublimed Sulphur, Warm Water, each two ounces. On the lime in an earthen vessel sprinkle the water, and cover the vessel until the lime fall to powder. Mix the powder, when cold, by trituration with the sulphur and muriate of ammonia, avoiding the vapours: Put the mixture into a retort, and distil with a heat suddenly raised, and sufficiently strong. Keep the liquor thus obtained in a phial closely stopt with a glass stopper.

This preparation is similar to one long known to chemists by the name of Fuming Liquor of Boyle, and which Berthollet considered as a hydro-sulphuret of ammonia much concentrated, with an excess of ammonia, to which he ascribed its fuming property. As muriatic acid, when added to it, causes not only a disengagement of sulphuretted hydrogen, but likewise a precipitation of sulphur, it is probably rather a sulphuretted hydro-sulphuret. It has not been applied to any medicinal use.

SULPHAS ALUMINÆ EXSICCATUS, *olim Alumen Ustum.* Dried Alum. Ed.

Let Alum be liquefied in an earthen or iron vessel, and exposed to heat until it cease to boil.

**Alumen exsiccatum.** Dried Alum. Lond.

Melt Alum in an earthen vessel on the fire; then let the heat be increased, until ebullition cease.

**Alumen ustum.** Burnt Alum. Dub.

Take of Alum, any quantity. Expose it to a strong heat in an earthen vessel, until it cease to boil.

In this process, the alum loses its water of crystallization; it is deprived of its hardness, and resolved into a spongy mass, easily reducible to a fine powder; and both from this, and from being rendered more active, it is better adapted to the purposes of an escharotic, to which it is applied.

**Liquor aluminis compositus.** Compound Solution of Alum. Lond.

Take of Alum, Sulphate of Zinc, each half an ounce; Boiling Water, two pints. Dissolve the alum and the sulphate of zinc in water; then strain through paper.

This forms a strong astringent solution, which has been employed to check hæmorrhage or profuse mucous discharges; and when considerably diluted, has been used as a collyrium.

**Murias barytæ.** Muriate of Barytes. Ed.

Take of Carbonate of Barytes, Muriatic Acid, each, one part; Water, three parts. To the water and acid mixed together, add the carbonate, bruised into small pieces. The effervescence being finished, digest for an hour, then strain, and after due evaporation put the liquor aside that crystals may form. Repeat the evaporation as long as there is any formation of crystals.

If the carbonate of barytes cannot be procured, the muriate may be prepared from the sulphate, in the following manner:

Take of Sulphate of Barytes, two pounds; Wood Charcoal in powder, four ounces. Calcine the sulphate, that it may be the more easily reduced to a fine powder, with which is to be mixed the powder of charcoal. Put this into a crucible, and having adapted a cover, urge it with a strong fire for six hours. The matter being well triturated, put it into six pounds of Boiling Water, in a closed glass or earthen vessel, and mix them by agitation, preventing, as much as possible, the access of the air. Let the vessel stand in a vapour bath, until the part not dissolved has subsided; then pour off the liquor. Pour on the residuum four pounds of boiling water, which, after agitation and subsidence, add to the former liquor. While it is yet hot, or, if it has cooled, having again heated it, drop into it Muriatic Acid as long as effervescence is excited. Then strain it, and evaporate, that it may crystallize.

The first of these processes is the most easy of execution, the muriatic acid combining readily with the barytes, and disengaging the carbonic acid; the muriate of barytes remains dissolved, and by evaporation is obtained crystallized. But the native carbonate of barytes not being an abundant mineral production, is not always to be procured: the second process, therefore, is inserted, in which the sulphate, which is a more common fossil, is substituted. In this process, the carbonaceous matter with which the sulphate is heated attracts the oxygen of the sulphuric acid; the sulphur remains united with the barytes. This sulphuret of barytes is dissolved by the water, and freed from any undecomposed sulphate; but in dissolving, it is at the same time, like other sulphurets with an alkaline or earthy base, partially changed; a portion of its sulphur attracts oxygen from the water, reproducing sulphuric acid, with which a little barytes unites and is precipitated; the hydrogen of the decomposed water unites with another portion of sulphur, forming sulphuretted hydrogen, which enters into combination with the remaining sulphuret of barytes, and prevents its farther decomposition, forming what may be named a sulphuretted hydro-sulphuret. When the muriatic acid is dropt in, it combines with the barytes, disengages the sulphuretted hydrogen, and precipitates the sulphur. The solution of muriate of barytes, on evaporation, affords the salt crystallized. This process, though a little complicated, is perhaps preferable to any other, as it must afford the barytic salt free from any metallic impregnation; for, if any metallic matter be mixed with the sulphate, being reduced by the charcoal, it will not be dissolved in any subsequent step of the process.

Muriate of barytes crystallizes in quadrangular tables: its crystals are soluble in five parts of cold and three of hot water: they are also soluble in alkohol. They consist of 64 of barytes, 21 of acid, and 15 of water. The taste of the salt is harsh and styptic: it proves poisonous to animals, and has been employed medicinally, as has been already stated, principally as a remedy in scrofula.

SOLUTIO MURIATIS BARYTÆ. Solution of Muriate of Barytes. Ed.

Take of Muriate of Barytes, one part; Distilled Water, three parts. Dissolve.

This saturated solution is designed to afford a preparation of uniform strength,—a circumstance of importance, as from the activity of the medicine its dose requires to be regulated with some care. Five drops are given twice a-day, and gradually increased to twenty or more.

CARBONAS CALCIS PRÆPARATUS, *olim Creta Præparata et Cancrorum Lapilli, vulgo Oculi Cancrorum Præparati.* Prepared Carbonate of Lime, formerly Prepared Chalk, and Prepared Crabs Stones, commonly called Crabs Eyes. Ed.

Carbonate of Lime, whether the softer variety, commonly named Chalk, or the harder, called Crabs Stones and Crabs Eyes, after being rubbed to powder in an iron mortar, and levigated with a little water on a porphyry stone, is to be put into a large vessel. Water is to be poured upon it, and after the vessel has been frequently agitated, it is to be poured off, loaded with the fine powder. On the water remaining at rest, a subtle powder subsides, which is to be dried. The coarse powder which the water could not suspend, is to be again levigated, and treated in the same manner.

CRETA PRÆPARATA. Prepared Chalk. Lond.

Take of Chalk, a pound. Add a little water to the chalk, and rub, so as to form a fine powder. Put this into a large vessel filled with water; then shake it, and, after a short time pour off the water while still turbid into another vessel, and put it aside, that the powder may subside. Lastly, having poured off the water, dry the powder.

Prepared Shells (TESTÆ PRÆPARATÆ) are prepared in the same manner, being previously freed from impurities by washing with boiling water.

CRETA PRÆPARATA. Prepared Chalk. Dub.

Rub Chalk to powder in an earthen mortar, adding a little Water. Mix it with a sufficiently large quantity of water by agitation; after a short time, when the coarser particles have subsided, pour off the liquor. This may be done frequently repeating the trituration. Lastly, collect the very fine powder which after some time subsides from the liquor poured off, and dry it on a bibulous stone or paper.

Prepared Oyster Shells (OSTREARUM TESTÆ PRÆPARATÆ) and Prepared Egg Shells (OVORUM TESTÆ PRÆPARATÆ) are prepared in the same manner.

Chalk is a native carbonate of lime, seldom perfectly pure, but containing often portions of argillaceous and siliceous earths. The crabs stones are concretions found in the stomach of the river craw-fish, (Cancer Astacus). They are collected when the animal is in a putrid state, are washed and dried. They have the advantage of being free from any gritty particles, and form therefore a smoother powder. They consist of carbonate and phosphate of lime, with a portion of gelatin; the proportion of carbonate being about seventy, of phosphate ten or twelve. Shells are of similar composition; but for all these, there is generally substituted in the shops chalk prepared with more care, and having a little gelatin diffused through it. They are used as antacids.

Creta præcipitata. Precipitated Chalk. Dub.

Take of Solution of Muriate of Lime, any quantity. Add to it, of Carbonate of Soda, dissolved in four times its weight of warm distilled water, as much as may be sufficient to precipitate the chalk. Render the precipitate pure, by allowing it to subside three times, and washing it each time with a sufficient quantity of water. Then collect it, and dry it on a chalk stone or bibulous paper.

In this process, the muriate of lime is decomposed by double affinity, the muriatic acid being attracted by the soda, and the carbonic acid combining with the lime. It affords a pure carbonate of lime, but is scarcely of sufficient importance to be received as an officinal preparation.

Potio carbonatis calcis, *olim Potio Cretacea.* Potion of Carbonate of Lime. Ed.

Take of Prepared Carbonate of Lime, an ounce; Refined Sugar, half an ounce; Mucilage of Gum Arabic, two ounces. Rub them together, and then add gradually, Water, two pounds and a half; Spirit of Cinnamon, two ounces. Mix them.

Mistura cretæ. Chalk Mixture. Lond.

Take of Prepared Chalk, half an ounce, Refined Sugar, three drachms; Gum Arabic in powder, half an ounce; Water, a pint. Mix them.

Mistura cretæ. Chalk Mixture. Dub.

Take of Prepared Chalk, half an ounce; Refined Sugar, three drachms, Gum Arabic in powder, an ounce; Water, a pint. Mix by rubbing them together.

The chalk is in these mixtures suspended by the mucilage; they afford a form in which it is given as an antacid, but it may be doubted whether the mucilage and sugar will not rather be injurious in that state of the stomach which generates acidity. The dose is one or two ounces.

Calx. Lime. Lond.

Take of Limestone, a pound. Bruise it into small pieces, and calcine these in a crucible with a very strong fire for an hour, or until the carbonic acid is entirely expelled, so that acetic acid, when added, shall not disengage any bubbles of air. In the same manner, lime may be prepared from shells, after these have been washed in hot water, and freed from their impurities.

There is little advantage in the introduction of this process; lime prepared on the large scale, for the numerous uses to which it is applied, being sufficiently pure for any medicinal purpose, especially as, when it is internally administered, it must be given in solution; and in the state in which it is usually met with, it impregnates water just as strongly as lime in its purest state.

Aqua calcis. Ed.

Take of Lime recently prepared, half a pound: Put it into an earthen vessel, and sprinkle upon it four ounces of water, keeping the vessel closed while the lime becomes hot, and falls into powder; then pour on it twelve pounds of water, and mix them by agitation. After the lime has subsided, repeat the agitation; and do so about ten times, keeping the vessel always shut, that the free access of the air may be prevented. Let the water be strained through paper, interposing between the filter and the funnel glass rods, that the water may pass through as quickly as possible. Let it be kept in bottles well stopt.

LIQUOR CALCIS. Liquor of Lime. Lond.

Take of Lime, half a pound; of Distilled Boiling Water, twelve pints. Pour the water upon the lime, and shake them together, then immediately cover the vessel, and put it aside for three hours; afterwards keep the liquor with the remaining lime, in glass vessels closed, and when it is to be used pour off the clear liquor.

AQUA CALCIS. Lime Water. Dub.

Take of recently calcined Lime, a pound; Boiling Water, a pint. Put the lime into an earthen vessel, and sprinkle the water upon it, closing the vessel while the lime becomes hot and falls into powder, then pour upon it three gallons of cold water. The vessel being again closed, agitate the mixture frequently during twenty-four hours; lastly, strain the liquor through paper placed in a covered funnel, and keep it in vessels well stopt.

Lime is sparingly soluble in water; not more than $\frac{1}{500}$th being dissolved, at 60°. Yet, notwithstanding this small quantity, the water has a strong styptic taste, and changes the vegetable colours to a green. The caution to exclude the air in this process, arises from the supposition that the lime would combine rapidly with the carbonic acid of the atmosphere. After the solution is strained, it is at least necessary that it should be kept in vessels well stopt, and the direction of the London College is perhaps preferable, to keep it in contact with the lime, pouring it off when required for use. Lime water is the form under which lime is always used internally. It is employed as a tonic, astringent, and antacid in dyspepsia, chronic diarrhœa, and leucorrhœa. Its dose is from one to two pounds daily.

Aqua calcis composita. Compound Lime Water. Dub.

Take of Guaiac Wood in shavings, half a pound; Liquorice Root cut and bruised, an ounce; Bark of Sassafras bruised, half an ounce; Coriander Seeds, three drachms; Lime Water, six pints. Macerate them without heat for two days, and strain.

The lime water can derive very little additional power from these ingredients, and they, on the other hand, must have their powers very imperfectly extracted. The preparation is one, therefore, which can have little activity.

Solutio muriatis calcis. Solution of Muriate of Lime. Ed.

Take of Pure Carbonate of Lime (namely White Marble), in small pieces, nine ounces; Muriatic Acid, sixteen ounces; Water, eight ounces. Mix the acid with the water, and add gradually the pieces of carbonate of lime. The effervescence being finished, digest for an hour. Pour off the liquor, and reduce it by evaporation to dryness. Dissolve the residuum in its weight and a half of water, and strain.

Aqua muriatis calcis. Water of Muriate of Lime. Dub.

Take of Chalk in coarse powder, an ounce; Diluted Muriatic Acid, two ounces. To the acid add gradually the chalk, and the effervescence being finished, strain.

The muriatic acid combines with the lime, and disengages the carbonic acid. To remove any superfluous acid, and obtain a solution of uniform strength, the solid salt is in the first process obtained by evaporation, and is then dissolved in a fixed proportion of water. The solution of muriate of lime has been recommended as a tonic, similar, and not inferior to the muriate of barytes. The dose is from fifteen to twenty grains of the dried salt, or thirty drops of the solution.

CARBONAS MAGNESIÆ, *olim Magnesia Alba.* Carbonate of Magnesia. Ed.

Take of Sulphate of Magnesia, Carbonate of Potash, of each equal weights. Let them be dissolved separately in twice their weight of warm water, and either strained or otherwise freed from impurities. Then mix them, and immediately add eight times their weight of boiling water. Boil the liquor for a short time, stirring it, then allow it to remain at rest, until the heat be diminished a little, and strain it through linen, on which the carbonate of magnesia will remain. Wash it with pure water, until it be perfectly tasteless.

MAGNESIÆ CARBONAS. Carbonate of Magnesia. Lond.

Take of Sulphate of Magnesia, of Sub-Carbonate of Potash, each a pound; of Water, three gallons. Dissolve separately the sub-carbonate of potash in three pints of water, and the sulphate of magnesia in five pints of water, and strain; then add the remaining water to the liquor of the sulphate of magnesia, and boil; add the former liquor to it whilst it boils, constantly stirring with a spatula; afterwards strain through linen; lastly, wash the powder, by frequently pouring on it boiling water, and dry it on bibulous paper by a heat of two hundred degrees.

MAGNESIA. Magnesia. Dub.

Take of Sulphate of Magnesia, Sub-Carbonate of Potash; of each two pounds; Boiling Water, twenty pints. Dissolve the sulphate of magnesia and the sub-carbonate of potash, each in ten pounds of water. Mix the clear liquors, boil the mixture a little, and strain it while warm, through linen stretched, so as to collect the magnesia. Wash out the sulphate of potash, by frequently pouring on boiling water; lastly, dry the magnesia.

In this process there is a mutual decomposition of the salts, the sulphuric acid of the sulphate of magnesia combining with the potash of the carbonate of potash, and the carbonic acid uniting with the magnesia. The use of adding the boiling water, and boiling the liquor, is, partly to dissolve the sulphate of potash, which is a salt sparingly soluble, and partly to prevent a species of crystallization which the carbonate of magnesia would undergo, rendering it gritty, and thus give it a smoothness which it has not when this precaution is not observed. Carbonate of magnesia, however, is generally prepared on a large scale from the Bittern, or liquor remaining after the crystallization of muriate of soda from sea-water, which is principally a solution of muriate of magnesia. This is decomposed by carbonate of potash, or sometimes by an ammoniacal carbonate, and there are some niceties of manipulation requisite to give it the whiteness, lightness, and smoothness, which are valued as marks of its goodness. Hence it is superior in these qualities to what it would be were it prepared by the above process on a small scale. In the process of the Pharmacopœias, more of the alkaline carbonate is employed than is strictly necessary; three parts of it, according to Mr Phillips, decompose four parts of the sulphate of magnesia.

This substance, properly prepared, is nearly insipid; it is extremely light, white, and smooth to the touch; is insoluble in water. It consists of from 45 to 55 of magnesia, from 25 to 48 of carbonic acid, and from 15 to 30 of water. What appears to be the neutral carbonate, obtained in crystals by mixing the saline solutions without applying heat, consists of 25 of magnesia, 50 of acid, and 25 of water. The common preparation is therefore a sub-carbonate. The popular name of Magnesia, though incorrect as applied to it, is retained by the Dublin College. It is given as an antacid in a dose from a scruple to a drachm, and usually produces at the same time a laxative effect.

MAGNESIA, *olim Magnesia Usta.* Magnesia. Ed.

Let Carbonate of Magnesia be exposed in a crucible to a red heat, for two hours. Then preserve it in glass phials well stopt.

MAGNESIA. Magnesia. Lond.

Take of Carbonate of Magnesia, four ounces. Calcine it with a very violent heat for two hours, or until acetic acid dropt upon it does not excite effervescence.

MAGNESIA USTA. Calcined Magnesia. Dub.

Take of Magnesia any quantity. Put it into a crucible, and submit it to a strong heat for two hours. Keep the magnesia, when cold, in a glass vessel.

By the heat applied, the carbonic acid of the carbonate, and a considerable portion of its water, are expelled, and the pure magnesia remains. It loses about half its weight. A smaller quantity, therefore, of the pure magnesia, will produce the same effect as a larger of the carbonate. It is preferred to the latter, both from this circumstance, and also, where, from the abundant acidity on the stomach, flatulence is occasioned by the disengagement of carbonic acid when the carbonate is used. The sub-carbonate employed in its preparation requires to have been very carefully washed, for if even a minute quantity of sulphate of potash adheres to it, which is liable to be the case where the washing has not been thoroughly performed, this seems to be decomposed by the heat applied for the calcination, and a very disagreeable sulphureous taste is communicated to the calcined magnesia.