ORDER 10. COMPOUNDS OF POTASSIUM.

Potas'sa.—Pot'ash.

HISTORY.—Caustic alkaline solutions were probably known to the Greeks and Romans. We learn from Pliny (*Hist. Nat.* lib. xxviii. cap. li.), that soap was made in his time from tallow and wood-ashes; and we may therefore conclude that some method was known of depriving the alkaline carbonate of its carbonic acid. Geber (*Invention of Verity*, ch. iv.) describes the method of making caustic alkali. Black, however, in the year 1756, first distinguished, chemically, the caustic alkalies from their carbonates. Potash was formerly called *kali*, or the *vegetable alkali*.

NATURAL HISTORY.—Potash in combination with acids is found in both kingdoms of nature.

(*a.*) *In the inorganized kingdom.*—Potash is found, in the mineral kingdom, in combination with sulphuric, nitric, silicic, and perhaps carbonic acids. As an ingredient of rocks, it is more abundant than soda.

(*b.*) *In the organized kingdom.*—In organized beings potash is met with in combination with phosphoric, sulphuric, nitric, carbonic, and various organic acids. It occurs more abundantly in vegetables than in animals.

PREPARATION. (*a.*) *Of aquæ potassæ.*—To prepare a solution of caustic potash, add fresh burned lime to a solution of the carbonate of potash. In the London Pharmacopœia the proportions employed in the manufacture of *liquor potassæ* are fifteen ounces of the carbonate, eight ounces of lime, and a gallon of boiling distilled water. The lime, when slacked and mixed with half a gallon of water, is to be added to the carbonate of potash dissolved in the remaining half gallon of water. The mixture is to be kept in a close vessel, and frequently shaken. When cold, the supernatant clear liquor is to be poured off: this is the *liquor potassæ* of the Pharmacopœia.

In this process the lime abstracts carbonic acid from the carbonate of potash, and the potash thus set free dissolves in the water.

REAGENTS.			RESULTS.
Water			Liquor Potassæ (Ph. L.)
1 eq. Carb. Potash	70	1 eq. Potash . . . 48	
		1 eq. Carbon^c. A^d. 22	
1 eq. Lime	28		1 eq. Carbon^e. Lime . . 50

It is best to avoid filtering the liquid, but to decant it. If, however, a filter be employed, it should be of cotton or linen, and the atmospheric air should be, as much as possible, excluded; as the solution readily decomposes paper and woollen cloth, and abstracts carbonic acid from the air.

(*b.*) *Of hydrate of potash.*—If liquor potassæ be evaporated to dryness in a clean iron vessel, and the residual mass fused and poured into moulds, we obtain the *hydrate of potash* of the Pharmacopœia, and which was formerly called *potassa fusa*, *kali purum*, *lapis infernalis sive septicus*, or *cauterium potentiale.*

(*c.*) *Of potash with lime.*—To render the potash less deliquescent it is rubbed with an equal weight of lime, by which is procured the mixture termed *potassa cum calce.*

PROPERTIES. (*a.*) *Of hydrate of potash.*—The solid sold in the shops as *potassa fusa*, or hydrate of potash, is usually more or less coloured (brownish, greyish, or bluish), and not completely soluble in water and alcohol, in consequence of the presence of foreign matters; for pure hydrate of potash is white, and dissolves in both water and alcohol. During the solution in water heat is evolved. Its solubility in alcohol enables us to separate it from the carbonate and bicarbonate of potash, both of which are insoluble in this liquid. It has a strong affinity for water, which it rapidly attracts from the atmosphere, and in consequence becomes liquid. At a low red heat it fuses, and at a higher temperature is volatilized. It is odourless, but has a caustic, urinous taste. It rapidly decomposes organic substances. It possesses the properties of an alkali in an eminent degree.

(*b.*) *Of liquor potassæ.*—This liquid is limpid, colourless, transparent, and inodorous. Its taste is acrid: when prepared according to the London Pharmacopœia, its sp. gr. is 1·063. It has a soapy feel when rubbed between the fingers. It strongly attracts carbonic acid from the atmosphere, and, therefore, should be kept in close vessels. It corrodes flint glass, and is, on that account, directed to be kept in green glass bottles.

CHARACTERISTICS.—Potash free or combined is recognized by the following characters:—The hydrosulphurets, ferrocyanides, and carbonates, produce no precipitate with it. Tartaric (in excess), perchloric, and carbazotic acids, occasion precipitates of the bitartrate, perchlorate, and carbazotate of potash respectively. Chloride of platinum throws down a yellow precipitate with potash or its salts. Lastly, the potash salts communicate a violet tinge to the flame of alcohol.

The causticity of potash is shewn by its communicating a green colour to the infusion of red cabbage or syrup of violets; by its reddening turmeric, and restoring the blue colour of litmus reddened by an acid; by its not whitening lime water, or effervescing on the addition of an acid; by its soapy feel; by its solubility in alcohol; and by its dissolving alumina.

IMPURITIES.—Liquor potassæ usually contains a small quantity of carbonate of potash. This may be recognized either by lime-water, which renders the liquid turbid, or by a dilute mineral acid, which causes effervescence. When pure liquor potassæ has been saturated with nitric acid it gives no precipitate on the addition of carbonate of soda, chloride of barium, or nitrate silver: if the first cause a precipitate it would indicate some earthy or metallic impregnation; if there be a precipitate with the second, which is insoluble in nitric acid, we infer the presence of a sulphate; if the third cause a precipitate, soluble in ammonia, but insoluble in nitric acid, a chloride is present.

Potassa fusa of the shops contains various impurities, such as sesquioxide of iron, carbonate of potash, and silica. These, however, do not materially affect its medicinal value, and will not, therefore, require further notice.

COMPOSITION.—Pure *anhydrous potash* has the following composition:—

	Eq.	Eq.Wt.	Per Cent.	Berzelius.
Potassium	1	40	83·34	83·05
Oxygen	1	8	16·66	16·95
Potash	1	48	100·00	100·00

The *hydrate of potash* is thus composed :—

	Eq.	Eq.Wt.	Per Cent.	Berzelius.
Potash	1	48	84·2	84
Water	1	9	15·8	16
Hydrate of Potash	1	57	100·0	100

The strength of the *liquor potassæ* may be ascertained by taking its sp. gr. The following extract from Mr. Dalton's table (*New System of Chem. Philos.* part ii. p. 476) illustrates this:—

Atoms.		Potash per cent. by weight.	Spec. Gravity.	Boiling Point.
Potash.	Water.			
1	8	39·6	1·47	265 deg.
1	10	34·4	1·42	246
		26·3	1·33	229
		19·5	1·23	220
		13·	1·15	215
		9·5	1·11	214
		4·7	1·06	213

Hence it appears that the liquor potassæ of the London Pharmacopœia, whose sp. gr. is 1·063, consists of—

Potash	4·7
Water	95·3
Liquor Potassæ (Ph. L.)	100·0

Physiological Effects. (*a.*) *On vegetables.*—Caustic potash promptly destroys the parts of living plants with which it is placed in contact, and even in the dilute state kills haricots (*Phaseolus vulgaris*) in a few hours. (Marcet, in Decandolle, *Phys. Végét.*)

(*b.*) *On animals generally.*—It acts on animals generally as an energetic caustic poison. It is, says Orfila (*Toxicol. Génér.*), of all poisons that which most frequently perforates the stomach. He found that injected into the jugular vein of a dog it coagulated the blood, and caused speedy death. It is, however, remarkable that when mixed with the blood out of the body, it not only does not coagulate it, but actually prevents its spontaneous coagulation. Magendie has observed that by the exhibition of alkalies to dogs, the urine acquires alkaline properties.

(*c.*) *On man.*—The local action of caustic potash is exceedingly energetic. This is especially the case with solid potash. The alkali, of course, neutralizes any free acid in the part to which it is applied, and decomposes whatever ammoniacal salts may be present, causing the evolution of ammoniacal gas. Its chemical action on the organized tissues is most powerful, as may be well illustrated by experiments. Thus, if a little potash solution be rubbed between the fingers, the epidermis becomes corroded and dissolved, and a soapy feel is thereby produced. If a piece of fibrin (muscle, for example) be digested in a solution of potash, an unpleasant ammoniacal odour is evolved, a little alkaline sulphuret is formed, and the fibrin is dissolved: the compound of fibrin and potash thus formed may be termed *fibrate of potash*. The addition of an acid precipitates the fibrin somewhat altered in its properties, and combined with some of the precipitant. The same kind of effect is produced by the action of potash on albumen: thus, this substance unites with the alkalies to form soluble compounds, which may be termed *albuminates*. Gelatine is also readily dissolved by alkalies, with the deposition of any phosphate of lime which it may contain. These phenomena are to a certain extent comparable to those of saponification. It appears, therefore, that the caustic alkalies form soluble compounds with substances which enter largely into the composition of the organized tissues. Hence the observation of Orfila, that alkalies are of all corrosive poisons those which most frequently perforate the stomach, is readily accounted for; for the intestinal mucus readily dissolves in alkalies, whereas it is coagulated by acids; so that the former are much more quickly brought in contact with the living tissues. These resist, for a certain time, the chemical influence of the caustics, but the affinities being powerful, the vital properties soon cease to offer opposition—the part dies, and then the alkalies commence their chemical action on the tissues, which they speedily dissolve. Hence, if a large quantity of potash be swallowed, the most violent symptoms are observed, though they are of the same general kind as when the mineral acids have been taken.

When liquor potassæ is taken in small doses, and properly diluted, it saturates the free acids contained in the stomach, and which the recent investigations of physiologists have shown to be so essential to the digestive functions. Hence the continued use of alkalies must be always injurious, since they disorder the assimilative process by altering the chemical properties of the healthy ventricular secretion.

If the quantity of potash swallowed be more than sufficient to neutralize the free hydrochloric acid, but insufficient to have any chemical action on the living tissues, it acts as a slight irritant, increases the secretions of the alimentary canal, becomes absorbed, and alters the qualities of the secreted fluids, more particularly those of the urine. Moreover, the modification thus produced in the quality of the renal secretion is accompanied by an increase in the quantity, so that the alkalies rank among our most powerful diuretics—an effect which may be in part owing to the local stimulus which they communicate to the secreting vessels in their passage through them.

By continued use the alkalies give rise to increased activity of the different secreting organs, and of the absorbing vessels and glands; effects which are analogous to those caused by mercury. After some time the digestive function becomes disordered, the appetite fails, the blood becomes thinner and darker coloured, and loses its power of spontaneous coagulation when drawn from the body; the whole system, and more particularly the digestive organs, become enfeebled; and a state precisely similar to that of scurvy is brought on. It is said if the alkalies be temporarily suspended the blood speedily re-acquires its coagulability, but loses it again when we resume their employment. These phenomena deserve especial notice, as being precisely analogous to those of scurvy—a disease which has been usually supposed to be brought on by the use of salt and salted provisions, and to be prevented or cured by vegetable acids (especially the citric) and fresh provisions. It appears, therefore, in the highest degree probable, that scurvy, and the effects caused by the long-continued employment of the alkalies, are analogous conditions of system.

USES.—Caustic potash is employed for various purposes in medicine, the principal of which are the following:—

(*a.*) *As an escharotic.*—Potassa fusa is sometimes used as a caustic, though its employment is not free from objection; for its great deliquescence occasions some difficulty in localizing its action. It may be employed for the production of an issue, but we must proceed thus:—Apply to the part one or two layers of adhesive plaster, in the middle of which is an aperture of the exact size of the intended issue. Then moisten the *potassa fusa*, or the *potassa cum calce*, and rub on the part until discoloration is observed. Wash, and apply a linseed-meal poultice; and when the eschar is detached, insert the pea. In bites by poisonous animals—as venomous serpents, mad dogs, &c., this escharotic may be used with advantage. Mr. Whateley recommends the *potassa fusa* as the agent for arming caustic bougies to be applied in strictures of the urethra; but the practice appears so dangerous (particularly on account of the deliquescence and violent action of the caustic), that I believe it is now rarely, if ever, resorted to. There are many other cases in which this substance is employed as a caustic: for example, to destroy warts and fungoid growths of various kinds, and to open abscesses, more especially those in the groin; but for the latter purpose the lancet is to be preferred.

(*b.*) As an *antacid* we resort to the *liquor potassæ* in various affections of the digestive organs, which are attended with an inordinate secretion of acid, known by the acid eructations, cardialgia, and other dyspeptic symptoms. It must, however, be evident, that the neutralization of the acid is merely palliative. But the continued employment of alkalies frequently diminishes, temporarily, the tendency to acid secretion. Commonly it is found that the cases calling for the employment of alkalies are those benefited by tonics, and hence I believe the alkali is, in most cases, best given in some mild or tonic infusion; such, for example, as the infusion of calumba, or of gentian, or of quassia; the sulphate of quinia oftentimes disagreeing with the stomach in these cases; besides which, it would be decomposed by the alkali. The beneficial effects of alkalies are said to be particularly observed in those forms of dyspepsia which result from the inordinate use of spirituous liquors.

Of course the liquor potassæ would equally neutralize acid which may have been accidentally or purposely swallowed; but it is rarely given for this purpose, on account of its irritant qualities, and because many other agents (as chalk, whiting, magnesia, and soap) are equally efficacious as antacids, while they are free from the objections which exist in these cases to the use of the caustic alkalies.

(*c.*) *To modify the quality of the urine*, liquor potassæ is a most valuable agent. I have already stated that, under the employment of alkalies, not only may the natural acidity of the urine be destroyed, but even an alkaline property communicated to it; so that, whenever the secretion of lithic acid, or of the lithates, is inordinate, the alkalies present themselves to our notice as chemical agents for counteracting this condition. It has been supposed by some that the efficacy of the caustic alkalies in preventing the deposition of lithic acid gravel, consists in their holding it in solution — an explanation apparently inconsistent with the fact that the carbonated alkalies and magnesia are equally efficacious, though they are incapable of dissolving it. We are, therefore, led to the conclusion, that the alkalies, by their chemical influence, actually prevent the formation of this acid, or neutralize the free acid in the urine, which is the immediate cause of the precipitation of the lithic acid; whether by an action on the digestive organs or otherwise we know not. In resorting to these agents in urinary deposits, we should be careful to avoid employing them when there is any tendency to the deposition of the phosphates. The phosphate of lime, which naturally exists in the urine, is held in solution in this liquid by some acid, as seems proved by the fact, that the addition of a caustic alkali precipitates it. Berzelius thinks that the acid is the lactic; Mr. Brett (*Medical Gazette*, vol. xvii. p. 847), that it is the carbonic acid. The nature of the acid is, however, of secondary importance. It is generally admitted that the solvent is an acid, and that by the use of alkalies it may be obviated or neutralized, and the urine rendered alkaline. Now what will be the necessary consequence of this? Evidently the deposition of phosphate of lime; so that the use of alkalies may actually cause the appearance of *white sand* in the urine; and in patients predisposed to its formation, its quantity may be increased. These facts, then, have an important bearing on practice. "I have known," says Mr. Brande (*Quart. Journ. of Science*, vol. ii. p. 198), "soda-water exhibited in a case of stone in the bladder, *produce* abundance of white sand, which the ignorance of the patient and his medical attendant led them to refer to the solvent power of the medicine upon the stone, which they thought was gradually giving way and being voided; whereas great mischief was doing, by giving the urine more than its usual tendency to deposit the phosphates, and, consequently, to augment the size of the calculus." In the treatment of the lithic acid diathesis, it is to be remembered that the use of alkalies is, to a certain extent, a palliative mode of treatment, and that, to be successful, it should be conjoined with other means of cure.

(*d.*) The alkalies have been lately celebrated for producing beneficial effects in those *inflammations* which have a disposition to terminate in exudation and adhesion; that is to say, those that frequently give rise to the formation of false membranes or of adhesions; such, for example, as croup, pleurisy, and peritonitis. If experience should subsequently confirm the assertions already made respecting their efficacy, we shall have another analogy between the operation of alkalies and of mercury. Theoretically, it has been argued, the alkalies are likely to be beneficial in these diseases on two accounts; first, they have a tendency to diminish the supposed plasticity of the blood, which some have assumed (though without proof) to be connected with the exudation; and, secondly, we find these albuminous deposits readily dissolve, out of the body, in alkaline liquids: but arguments of this kind are to be received with great caution. In conclusion, I may add that Eggert recommends the alkalies as specifics against croup, though Sundelin (*Heilmittell.* 1^er^. Bd. S. 182) found them inoperative. Hellwag employed them to cause the removal of the deposited lymph; Memminger gave them with benefit in hooping-cough; Mascagni in pleurisy and peripneumony (Vogt, *Lehrbuch d.*

Pharmakodyn. 2^er^. Bd. p. 529). It is asserted that in the latter complaints the alkalies render the expectorated matter less viscid, and at the same time act powerfully as diaphoretics and diuretics.

(*e.*) In *induration* and *enlargement of the lymphatic* and *secreting glands* the alkalies have also been recommended: for example, in bronchocele, mammary tumors, affections of the testicle, diseases of the mesenteric glands, induration of the liver and salivary glands, &c. I have seen the liquor potassæ remarkably beneficial in excessive enlargement of the lenticular or glandular papillæ at the base of the tongue.

(*f.*) In *syphilis* and *scrofula* also the alkalies have been employed with advantage. Some of the most obstinate and troublesome forms of the venereal disease frequently occur in scrofulous subjects, in whom mercury will not only be useless, but absolutely prejudicial. In two or three cases of this kind I have seen the liquor potassæ, taken in the compound decoction of sarsaparilla, of great benefit. Though scrofula may be relieved by the use of alkalies, there is no ground for believing that they have any power of curing this malady, as some have asserted.

(*g.*) The alkalies have been employed as *diuretics in dropsy*, especially when this disease arises from glandular enlargements, or other causes likely to be relieved by these remedies.

(*h.*) In *irritable conditions of the urinary organs* a combination of liquor potassæ and tincture of opium will be frequently found most beneficial, notwithstanding that alkalies are classed among the incompatibles of opium.

(*i.*) There are several other diseases in which the employment of alkalies has been recommended; such as *skin diseases*, which are scaly (as lepra and psoriasis); *chronic rheumatism*; in *uterine complaints*, as an emmenagogue; and in some chronic *diseases of the lungs*. Sometimes a very dilute solution of potash has been used as a *stimulating wash* to ulcers.

Administration.—The mode of employing the *potassa fusa* in the making of an issue I have already described. For internal exhibition, the liquor potassæ is used in doses of ten drops gradually increased to the extent even of a drachm, carefully watching its effects. It may be administered in the infusion of orange-peel. Table beer is said, by Dr. Paris, to disguise completely the nauseous flavour of the alkali; but, of course, if the beer be at all sour, the acid will neutralize the alkali, and destroy its antacid properties. Veal broth is another liquid for its administration; and we are told that Dr. Chittick's nostrum for the stone was the fixed alkali in this liquid.

Antidotes.—In poisoning by the alkalies, the antidotes are either acids or oil, both of which form salts with the alkalies, and diminish their causticity. Chereau prefers oil, which should be given to the extent of several pounds. Vinegar, lemon or orange juice, even the very diluted mineral acids, should be resorted to, if oil be not at hand.

Potas'sii Io'didum.—I'odide of Potas'sium.

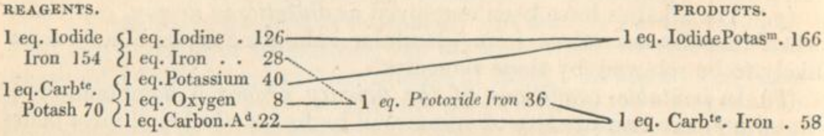
History.—This salt, called also *ioduret of potassium*, and more commonly *hydriodate of potash*, was first employed in medicine by Dr. Coindet.

Natural History.—Iodine and potassium are contained in sea-water, as well as in sea-weeds, but whether the iodine is in combination with potassium or with some other metal (sodium or magnesium) it is impossible to say with certainty.

Preparation.—There are two principal methods of procuring this salt.

(*a.*) *Process of the Pharmacopœia.* — This consists in adding two ounces of iron filings to six ounces of iodine mixed with four pints of water, stirring them frequently with a spatula for half an hour. Apply a gentle heat, and, when a greenish colour appears, add four ounces of carbonate of potash, first dissolved in two pints of water, and strain. Wash the residue with two pints of boiling distilled water, and again strain. Let the mixed liquor be evaporated, that crystals may be formed.

The *theory* of this process is as follows:—One equivalent or 126 parts of iodine combine with one equivalent or 28 parts of iron. The resulting iodide of iron is decomposed by one equivalent or 70 parts of carbonate of potash, by which one equivalent or 166 parts of iodide of potassium and one equivalent or 58 parts of protocarbonate of iron are procured.



(*b.*) *Dr. Turner's process.*—This is the simplest, and I believe the most eligible method. It consists in adding to a hot solution of pure potash as much iodine as the liquid will dissolve, by which means a reddish-brown fluid is obtained. Then pass hydrosulphuric acid through the liquid until it becomes colourless. Apply a gentle heat, to expel any excess of the acid; filter to get rid of the free sulphur, and exactly neutralize the free acid present, with potash; then crystallize. When the potash comes in contact with iodine two salts are formed, iodide of potassium and iodate of potash: the latter is decomposed by the hydrosulphuric acid, the hydrogen of which forms water, by combining with the oxygen of the iodate; sulphur is precipitated, and iodide of potassium remains in solution. This process has been subsequently modified thus: Iodate of potash is decomposed by exposing it to a red heat in a platinum crucible, instead of hydrosulphuric acid.

Properties.—This salt occurs in white, somewhat shining, transparent, or semi-opaque cubes, or octahedrons. Its taste is acrid saline, somewhat similar to common salt: it is without odour. It is readily fusible, and at a red heat volatilizes unchanged. It decrepitates when heated, in consequence of the water which is mechanically lodged between the plates of the crystal. Both water and alcohol readily dissolve it: it requires only two-thirds of its weight of water to dissolve it at 60° F. Iodine is readily dissolved by an aqueous solution of this salt.

Characteristics.—This salt is known to be an iodide by the following characters:—(*a.*) With a solution of bichloride of mercury it occasions a vermilion-red precipitate of the biniodide of mercury, which is very soluble in excess of iodide of potassium. (*b.*) With acetate of lead it forms a yellow precipitate of the iodide of lead. (*c.*) With the nitrate of silver, a yellow precipitate of the iodide of silver. (*d.*) With the protonitrate of mercury or with calomel a greenish yellow precipitate of the protiodide of mercury. (*e.*) On the addition of starch and a few drops of either sulphuric or nitric acid, or of a solution of chlorine, (according to Devergie, a mixture of chlorine and nitric acid succeeds best) the blue iodide of starch is formed. (*f.*) Chloride of platinum produces a brownish red solution of iodide of platinum.

That the base of this salt is potassium is shewn by the following characters :—(*a.*) Perchloric acid occasions a white precipitate of perchlorate of potash, while the supernatant liquid becomes yellowish brown. (*b.*) An excess of a strong solution of tartaric acid produces a white precipitate of the bitartrate of potash. (*c.*) Carbazotic acid forms yellow needle-like crystals of carbazotate of potash. (*d.*) If a pack-thread be soaked in a solution of the iodide, and the wetted end dipped into melted tallow, and applied to the exterior cone of the flame of a candle, this cone assumes a pale or whitish violet colour.

COMPOSITION.—This salt consists, as its name indicates, of iodine and potassium.

	Eq.	Eq.Wt.	Per Cent.	Gay-Lussac.
Iodine	1	126	76	76·2
Potassium	1	40	24	23·8
Iodide Potassium	1	166	100	100·0

The crystals contain no water of crystallization.

ADULTERATION.—Iodide of potassium is frequently largely adulterated with carbonate of potash. In 1829 I analyzed a sample which contained 77 per cent. of the latter salt (*Med. and Phys. Jour.* September, 1829.) In one specimen Dr. Christison procured 74·5 per cent. of carbonate of potash, 16 of water, and only 9·5 of iodide of potassium (*Treatise on Poisons*, 3d edit. p. 182.) It is reported that this adulterated salt is manufactured in the neighbourhood of Glasgow. The impure salt may be distinguished, by its wanting any regular crystalline form; by adding a few particles of it to lime-water a milky fluid is obtained, whereas the liquid remains transparent if the iodide be pure; by its destroying the colour of tincture of iodine, whereas the pure salt does not affect it; and lastly, by alcohol, which dissolves iodide of potassium, but not carbonate of potash.

Traces of the chlorides and sulphates are not unfrequent in commercial iodide of potassium. To detect the chlorides add nitrate of silver, which precipitates the carbonates, chlorides, and iodides, and digest the precipitate in ammonia, which re-dissolves the chloride, but not the iodide of silver. On the addition of nitric acid to the ammoniacal solution, the chloride is thrown down, while the carbonate is converted into nitrate of silver. The sulphates may be detected by chloride of barium, which will occasion a white precipitate (sulphate of baryta) insoluble in nitric acid.

I have met with a variety of iodide of potassium, which, by keeping, undergoes decomposition, evolves an odour of iodine, and becomes yellow. I have also samples of iodide of potassium (crystallized in octahedrons), containing traces of lead and tin, derived I presume from the vessels in which the salt has been made or crystallized.

PHYSIOLOGICAL EFFECTS. (*a.*) *On plants.*—The effects of this salt on vegetables have not been ascertained.

(*b.*) *On animals generally.*—The experiments of Devergie on dogs (referred to in his *Médecine Légale*, t. ii. p. 536), as well as those of Dr.

Cogswell on rabbits (*Experim. Essay on Iodine*, 1837), have shewn that, to these animals, iodide of potassium is a powerful poison. It operates as a local irritant, and thereby inflames the tissues with which it is placed in contact. Four grains injected into the jugular vein of a dog caused convulsions, and death within a minute. Two drachms introduced into the stomach gave rise to vomiting and great depression: the latter increased until death, which occurred on the third day: after death ecchymosis, ulceration, and redness of the stomach, were observed. (Devergie, *op. cit.* p. 506.) Dr. Cogswell injected three drachms of the iodide beneath the skin of the back of a dog: the animal died on the third day: on chemical examination iodine was detected in the blood from the heart, in the brain and spinal cord, the liver, spleen, stomach, muscles, tongue, and the bones freed from their appendages; likewise in the contents of the bladder. (Cogswell, *op. cit.* p. 91.)

(*c.*) *On man.*—Both the physiological effects and therapeutical uses of iodide of potassium shew that the operation of this salt is analogous to that of iodine.

The *local action* of iodide of potassium is that of an irritant. When taken internally in large doses it not unfrequently occasions nausea, vomiting, pain and heat of stomach, and purging. Applied to the skin in the form of ointment it sometimes produces slight redness. This salt is much less energetic in its action than free iodine, and, therefore, may be given in larger doses and continued for a longer period, without evincing the same tendency to produce disorder of the stomach and intestinal canal. Lugol (*Essays*, translated by Dr. O'Shaughnessy, p. 65) found that baths at 100° F. containing three ounces of iodide of potassium produced temporary itching only; whereas baths at the same temperature containing ten scruples of iodine caused prickling, then itchiness, smarting, rubefaction (which was not commensurate with the itchiness), punctuated, separated, or confluent, and subsequently desquamation of the epidermis. The chemical action of iodide of potassium on the tissues is slight, as indeed might be expected, seeing that no obvious changes are produced when a solution of this salt is mixed with albumen, fibrin, or gelatine, the three most abundant organic constituents of the animal body.

Iodide of potassium *becomes absorbed* and is carried out of the system by the different secretions, in which, as well as in the blood, it may be easily detected (Buchanan, *Med. Gaz.* vol. xviii. p. 519; Wallace, *Lancet*, for 1835-36, vol. ii. p. 6: the latter authority failed to detect it in the blood). Moreover, it deserves especial notice that it has been found in the urine several days after it has been swallowed. (Christison, *Treatise on Poisons*, 3rd ed. p. 185.)

The *remote* or *constitutional effects* of iodide of potassium are very analogous to those of iodine. Diuresis is a common consequence of its use. Relaxation of bowels is not unfrequent. Occasionally ptyalism has been observed. (Dr. Clendinning, *Med. Gaz.* vol. xv. p. 869, and Dr. Wallace, *Lancet*, for 1835 and 36, vol. ii. p. 8.) Dr. Wallace mentions irritation of throat as being produced by this salt. Atrophy of the mammæ is a very rare effect of it, but a case is mentioned by Mr. Nesse Hill, (*Edinb. Med. and Surg. Journ.* vol. xxv. 1826, p. 282.) Headache, watchfulness, and other symptoms indicative of the action of this salt on the nervous system, have been noticed by Dr. Clendinning and Dr. Wallace.

Increased secretion from, and pain of, the mucous membrane lining the nasal passages, have been observed. I have repeatedly remarked that the pocket-handkerchiefs used by patients who are taking this salt acquire a distinct odour of iodine.

Great discrepancy exists in the statements of authors as to the effects of given doses of iodide of potassium. "The average dose of this medicine," says Dr. Williams (*Med. Gaz.* vol. xiv. p. 42) "is eight grains; carried beyond that quantity it purges; and even limited to that quantity, it requires some management to obviate nausea." In two cases mentioned by Dr. Wallace (*Lancet*, for 1835-6, vol. ii. p. 9) a drachm of this salt taken in divided doses caused vomiting, colicky pains, slight diarrhœa, frequency of pulse, and exhaustion. These statements, then, shew that this salt possesses very active properties, and coincide with the experience of many practitioners, and with the results obtained from experiments on animals. But we have, in opposition to the above, the evidence of Dr. Elliotson (*Lancet*, vol. i. 1831-2, p. 728) and of Dr. Buchanan (*Med. Gaz.* vol. xviii. p. 519). The first tells us that six drachms may be given daily (in doses of two drachms) for many weeks without inconvenience; and the second states half an ounce may be given at a dose without producing pain of the stomach or bowels, purging, or any hurtful effect. Furthermore, both physicians vouch for the purity of the salt employed. It is difficult to explain such discrepant statements. But I cannot help thinking that peculiarities of constitution and morbid conditions of system (especially affections of the stomach) are principally concerned in modifying (either increasing or diminishing) the tolerance to this salt. I do not think that the different effects observed can be wholly ascribed to alterations in the quality or adulterations of the medicine employed, though I have published a case (*Med. Gaz.* vol. xvii. p. 839), shewing that the adulterated is much less active than the pure salt.

USES.—Having so fully detailed (p. 117 *et seq.*) the uses of iodine, it is unnecessary to notice at any length those of iodide of potassium, since they are for the most part identical. Thus it has been employed in bronchocele, scrofula, in chronic diseases accompanied with induration and enlargement of various organs, in leucorrhœa, secondary syphilis, periostitis, articular rheumatism, dropsies, &c. As a remedy for the hard periosteal node brought on by syphilis, it was first employed by Dr. Williams (*Med. Gaz.* vol. xiv. p. 42) who obtained with it uniform success. At the end of from five to ten days its mitigating effects are felt; the pains are relieved, the node begins to subside, and in the majority of cases disappears altogether. In these cases Dr. Clendinning (*Med. Gaz.* vol. xv. p. 833) has also borne testimony to its efficacy. In the tubercular forms of venereal eruptions, Dr. Williams found it beneficial. In Dr. Wallace's lectures (*Lancet*, for 1835-36, vol. ii. and for 1836 and 1837, vols. i. and ii.) are some valuable observations on the use of iodide of potassium in venereal diseases. In chronic rheumatism accompanied with alteration in the condition of the textures of the joint, it is, in some cases, remarkably successful (Dr. Clendinning, *Med. Gaz.* vol. xv. p. 866; and Dr. Macleod, *Med. Gaz.* vol. xxi. p. 361). As an ingredient for baths, Lugol (*Essays*, p. 75) found the iodide would not answer alone, but that it was useful as a solvent means for iodine.

ADMINISTRATION.—Iodide of potassium may be employed alone or in conjunction with iodine, forming what is called ioduretted iodide of potassium.

1. *Of Iodide of Potassium.*—*Internally* it has been given in doses varying from three grains to half an ounce (see p. 283). To be beneficial, some think it should be given in small, others in large doses. Not having had any experience of the effects of the enormous doses before referred to, I can offer no opinion thereon. It may be administered dissolved in simple or medicated water, or in some bitter infusion. The more usual mode of exhibiting it is in combination with iodine, in the way presently to be noticed.

For *external application* iodide of potassium is used in the form of ointment. The *unguentum potassæ hydriodatis* of the Dublin Pharmacopœia consists of a scruple of iodide to an ounce of lard; but for ordinary purposes it should contain at least a drachm of iodide. By keeping, it undergoes decomposition and acquires a yellow colour, a little iodine being set free. It has an advantage over the compound iodine ointment of the London Pharmacopœia, that it does not stain the skin.

2. *Of Ioduretted Iodide of Potassium.*—A solution of iodide of potassium readily dissolves free iodine, and the compound is usually termed ioduretted iodide of potassium. Iodine and iodide of potassium are also used together in the form of ointment.

For *internal administration* there are three preparations of ioduretted iodide of potassium which have been employed: the *ioduretted mineral water* of Lugol; the *compound solution of iodide of potassium* of the London Pharmacopœia; and the *compound tincture of iodine* of the same work.

(*a.*) *Ioduretted mineral water.*—This is Lugol's favourite preparation. He uses it of three different degrees of strength.

	No. 1.	No. 2.	No. 3.
Iodine	gr. ¾	i	i¼
Iodide of Potassium	gr. i½	ii	ii½
Distilled Water	℥ viii	℥ viii	℥ viii.

The solutions are yellowish or orange coloured, and are quite transparent. When sweetened it is readily taken by children, but the sugar should be added at the time of administration, as in the course of a few hours it effects a chemical change in the solution. From six to eight ounces should be taken daily.

(*b.*) *Compound solution of iodide of potassium.*—The *liquor potassii iodidi compositus* of the London Pharmacopœia consists of:—

Iodine	gr. v.
Iodide of Potassium	gr. x.
Distilled Water	℥ xx.

It is a brown coloured solution, and may be usefully employed in the diseases of children. Dose for adults from two to six or more fluidrachms.

(*c.*) *Compound tincture of iodine.*—The *tinctura iodinii composita* of the London Pharmacopœia consists of:—

Iodine	℥ i.
Iodide of Potassium	℥ ii.
Rectified Spirit	O ii.

This solution may be mixed with water without any deposition of iodine. The dose of it at the commencement is ten minims, which may be gradually increased.

For *external application* ioduretted iodide of potassium is used in the form of aqueous solution, or of ointment.

(*a.*) *Caustic, rubefacient, and stimulant solutions.*—These are employed by Lugol of the following strengths:—

	Stimulating Washes.			Rubefacient Solution.	Caustic Solution.
	No. 1.	2.	3.		
Iodine.	gr. ii.	gr. iii.	gr. iv.	ʒ iv.	℥ i.
Hydriodate Potash	gr. iv.	gr. vi.	gr. viii.	℥ i.	℥ i.
Distilled Water. .	lb. i.	lb. i.	lb. i.	℥ vi.	℥ ii.

Lugol uses the stimulating washes in scrofulous ulcers, ophthalmia, fistulous abscesses, &c. When the scrofulous surfaces require stronger excitement than usual, he employs the rubefacient solution. In tubercular tumors which have obstinately resisted all other means of treatment, the rubefacient solution may be applied in admixture with linseed meal (forming the *ioduretted cataplasm* of Lugol). To prepare the mixture, the poultice is first made in the ordinary manner; and when moderately cool, a sufficient quantity of the rubefacient liquid poured on it with a wooden measure. The caustic solution is used for touching the eyelids and nasal fossæ, to repress excessive granulations, &c.

(*b.*) *Ioduretted baths.*—These are employed by Lugol in the treatment of scrofula. They are to be made in wooden vessels.

IODURETTED BATHS FOR CHILDREN.

Age.	Water.	Iodine.	Iodide of Potassium.
	(Quarts.)	(Troy Grains.	(Troy Grains.)
4 to 7	36	30 to 36	60 to 72
7 . . 11	75	48 . . 60 . . 72	96 . . 120 . . 144
11 . . 14	125	72 . . 96	144 . . 192

IODURETTED BATHS FOR ADULTS.

Degree.	Water.	Iodine.	Iodide of Potassium.
	(Quarts.)	(Drachms Troy.)	(Drachms Troy.)
No. 1.	200	2 to 2½	4 to 5
No. 2.	240	2 . . 2½ . . 3	4 . . 5 . . 6
No. 3.	300	3 . . 3½	6 . . 7

(*c.*) *Ioduretted ointment.*—The *unguentum iodinii compositum*, Ph. L., is made by rubbing half a drachm of iodine with a drachm of iodide of potassium and a fluidrachm of rectified spirit: then mix with two ounces of lard.

ANTIDOTES.—No chemical antidote is known. In a case of poisoning, therefore, the first object will be to evacuate the contents of the stomach, exhibit demulcent and emollient drinks, combat the inflammation by the usual antiphlogistic measures, and appease the pain by opiates.

Potas'sii Bro'midum.—Bro'mide of Potas'sium.

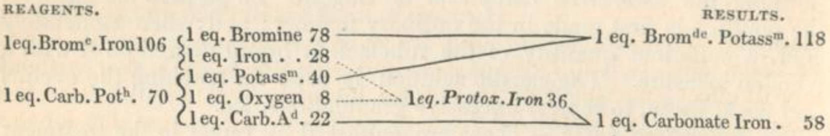
History.—This salt, also called *hydrobromate of potash*, was first described by Balard in 1826 (*Ann. de Chim.* xxxii.)

Natural History.—(See Iodide of Potassium).

Preparation.—The modes of preparing bromide of potassium are analogous to those of the iodide.

In the Pharmacopœia the bromide is directed to be made by adding first an ounce of iron filings and afterwards two ounces of bromine to a pint and a half of distilled water. Set them by for half an hour, frequently stirring with a spatula. Apply a gentle heat, and when a greenish colour is produced, pour in the carbonate of potash dissolved in a pint and a half of water. Strain and wash what remains in two pints of boiling distilled water, and again strain. Let the mixed liquors be evaporated so that crystals may be formed.

In this process bromide of iron is first formed, and afterwards decomposed by carbonate of potash, by which protocarbonate of iron and bromide of potassium are produced.



Another mode of procuring this salt is to mix bromine with a solution of caustic potash, by which bromide of potassium and bromate of potash are formed (see diagram, p. 123). The bromate of potash may be converted into bromide of potassium by heat or hydrosulphuric acid.

Properties.—This salt crystallizes in whitish transparent cubes, or rectangular prisms. It is inodorous: its taste is pungent, saline, and similar to common salt, but more acrid. It is permanent in the air. When heated it decrepitates, and at a red heat fuses without suffering decomposition. It is very soluble in both cold and hot water, and slightly so in alcohol.

Characteristics.—That this salt is a bromide is known by the characters before mentioned (see the characteristics of the bromides, at p. 124) That its base is potassium is shewn by the characters of this metal mentioned when noticing iodide of potassium (see p. 281.)

Composition.—This salt consists of bromine and potassium in the following proportions:—

	Eq.	Eq.Wt.	Per Cent.	Balard.	Liebig.
Bromine	1	78	66·1	65·56	67·42
Potassium	1	40	33·9	34·44	32·58
Bromide Potassium	1	118	100·0	100·00	100·00

The crystals contain water lodged mechanically between their plates, but no combined water (water of crystallization).

Purity.—The purity and goodness of this salt may be known by the following characters:—The form of the crystals, their freedom from colour, and their neutrality with respect to litmus and turmeric. A solution of this salt should give no precipitate with chloride of barium, shewing the absence of carbonates and sulphates. The method employed by Rose (*Journ. de Pharm.* t. 23, p. 489) for detecting minute quantities of the chlorides in bromides, is the following:—If pure bromide of potassium mixed with excess of bichromate of potash be distilled with concentrated sulphuric acid in a tubulated retort, to which is adapted a receiver containing excess of solution of caustic ammonia, pure brome distils over, and the ammoniacal liquor remains perfectly colourless. But if the bromide contained a chloride, both brome and the chromate of chloride of chromium distil over, and the ammoniacal liquor becomes yellow: chromic acid may be detected in the solution by the usual tests.

PHYSIOLOGICAL EFFECTS.—(*a.*) *On vegetables.*—The effects on plants have not been ascertained.

(*b.*) *On animals.*—Thirteen grains of bromide of potassium dissolved in water, and injected into the jugular vein of a dog, coagulated the blood, caused convulsions and death in a few minutes (Barthez, *Journ. de Chim. Méd.* t. 5^{me}. p. 214). The same experimenter introduced a drachm of the salt into the stomach of a dog without any ill effects, save vomiting. But two drachms, and even a drachm and a half, killed dogs in three days, when retained in the stomach by a ligature of the gullet, with marks of inflammation in the gastro-intestinal membrane. Maillet (*Journ. de Chim. Méd.* t. 3, 2^{e}. Serie, p. 225) gave two ounces to a dog without any ill effect; and he observes, that according to the principle, that the dose of a saline substance for the horse should be eight times that for the dog, a pound of bromide of potassium would have no ill effect on horses.

(*c.*) *On man.*—The effects of bromide of potassium on man require further investigation. They appear to be analogous to those of iodide of potassium. Dr. Williams (*Elements of Medicine*, vol. i. p. 338) gave five grains of this salt three times daily for fourteen months, without any injurious effect.

In most cases it acts as a diuretic. In irritable conditions of the alimentary tube it is apt to occasion diarrhœa. Three cases are mentioned by Dr. Williams, in which, on account of this state of the bowels, more than four or five grains could not be exhibited at a time, and even then it was occasionally necessary to give opium. Under the continued use of it, enlargements of the spleen and liver, and swellings of the lymphatic glands, have disappeared; so that it appears to agree with iodine, mercury, and the alkalies, in exercising that kind of influence over the nutrition of the body which has been designated by the terms resolvent, alterative, and deobstruent. Dr. Williams thinks that it possesses "unusual, if not specific, powers in the cure of diseases of the spleen."

USES.—In 1828, Pourché (*Journ. de Chim. Méd.* tom. iv. p. 594) employed this salt with benefit in the treatment of bronchocele and scrofula: it was taken internally, and applied externally in the form of ointment. In 1836 it was introduced into the London Pharmacopœia, in consequence of the great success obtained from the use of it in a case of enlarged spleen, under the care of Dr. Williams (*op. cit.*) In this, and in three other successful cases of the same disease, it was used internally only. Dr. Williams also gave it with success in a case of ascites. Magendie (*Formulaire*, 8^{me}. ed. 1835) employs it as an anti-scrofulous remedy, as an emmenagogue, and against hypertrophy of the ventricles. Prieger (quoted by Dierbach, *die neuesten Entdeck. in d. Mat. Med.* 1837) applied it externally in the form of ointment in tinea capitis.

Administration.—It is exhibited in the form of pill or solution in doses of from four to ten grains three times a day. An ointment of this salt is made by mixing an ounce of lard with from a scruple to two drachms of the bromide. To this some persons add free brome.

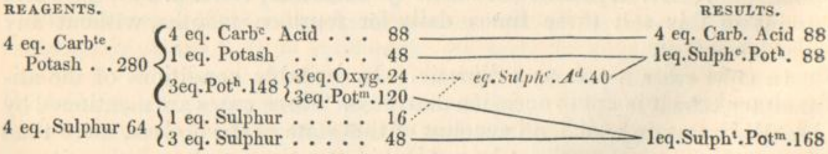
Antidotes.—In a case of poisoning by this salt the treatment will be the same as for iodide of potassium.

Potas'sii Sulphure'tum.—Sul'phuret of Potas'sium.

History.—Geber (*Invention of Verity*, ch. vi.) was acquainted with the solubility of sulphur in an alkaline solution; but Albertus Magnus taught the method of procuring sulphuret of potassium by fusion. The preparation kept in the shops is a mixture of the sulphuret of potassium and sulphate of potash, and was formerly called *sulphuret of potash*, or *liver of sulphur*.

Preparation.—It is ordered to be prepared by rubbing one ounce of sulphur with four ounces of carbonate of potash, and heating them in a covered crucible until they have united.

In this process the water and carbonic acid of the carbonate of potash are expelled. The oxygen and potassium of a portion of the potash unite with separate portions of sulphur to form sulphuric acid and a sulphuret of potassium respectively. The sulphuric acid combines with some undecomposed potash to form sulphate of potash. Supposing the carbonate of potash to be anhydrous, and the sulphuret of potassium to consist of one equivalent of each of its constituents, the following diagram will explain the changes:—



Berzelius (*Traité de Chim.* t. 2^me. p. 301) says that if 100 parts of common anhydrous carbonate of potash be heated with 58·22 of sulphur, the products are tersulphuret of potassium and sulphate of potash. If less than this quantity of sulphur be employed, a portion of carbonate remains undecomposed.

Properties.—When fresh prepared, it has a liver-brown colour; and hence its name *hepar sulphuris*. Its taste is acrid, bitter, and alkaline. If quite dry it is inodorous, but when moistened it acquires the odour of hydrosulphuric acid. Exposed to the air, it undergoes decomposition, from the action of the aqueous vapour and oxygen. It becomes green and moist, and ultimately whitish. This change depends on the absorption of oxygen, in consequence of which part of the sulphur is deposited, while a portion of the sulphuret of potassium is converted into hyposulphite, afterwards into sulphite, and ultimately into sulphate of potash. Sulphuret of potassium is soluble in water.

Characteristics.—Hydrochloric acid causes the evolution of hydrosulphuric acid gas and the precipitation of sulphur; the solution of the sulphuret in water produces a reddish or black precipitate with a solution of lead. That it contains potassium may be determined thus:—Add excess of hydrochloric acid to a solution of it; boil, and filter. The before-mentioned tests for potash may be then applied.

Composition.—According to Berzelius this preparation consists of *tersulphuret of potassium*, *sulphate of potash*, and *carbonate of potash*.

Physiological Effects. (*a.*) *On plants.*—There can be no doubt but that this compound is a powerful poison to plants, though I am not acquainted with any experiments made with it.

(*b.*) *On animals generally.*—From the experiments of Orfila (*Toxicol. Générale*) on dogs, sulphuret of potassium appears to be a powerful narcotico-acrid poison. Six drachms and a half, dissolved in water, and introduced into the stomach, caused convulsions and death in seven minutes.

(*c.*) *On man.*—In *small doses* (as from four to ten grains) it acts as a general stimulant, increasing the frequency of the pulse, augmenting the heat of the body, promoting the different secretions, more especially those of the mucous membranes, and sometimes exciting local irritation, marked by pain, vomiting, and purging. By continued use it acts as a resolvent or alterative, and on this account is employed in certain forms of inflammation.

In *large doses* it is an energetic narcotico-acrid poison. In two instances it proved fatal in fifteen minutes: the symptoms were, acrid taste, slight vomiting, mortal faintness, and convulsions, with an important chemical sign, the tainting of the air of the chamber with the odour of hydrosulphuric acid (Christison, p. 228).

Its local action is that of a powerful irritant: hence the acrid taste, burning pain, and constriction in the throat, gullet, and stomach, with vomiting and purging. But the nervous system also becomes affected, as is proved by the faintness, the almost imperceptible pulse, the convulsions, and (in some cases) sopor. These symptoms are analogous to those caused by the hydrosulphuric acid; which, in fact, is copiously developed in the stomach.

Uses.—Internally it has been administered in very obstinate skin diseases, such as lepra and psoriasis, which have resisted all the ordinary means of cure. It has also been employed as a resolvent in inflammations attended with lymphatic exudation, as croup, and in glandular enlargements. In chronic rheumatism, gout, hooping-cough, and various other diseases, against which it was formerly employed, it is now rarely if ever administered. It ought not to be given as an antidote for metallic poisoning, since it is itself a powerful poison.

Externally it is applied in the form of lotions, baths, or ointment. In chronic skin diseases, such as eczema, scabies, lepra, &c. it is employed as a bath, in the proportion of four ounces to thirty gallons of water. These baths are said to be particularly useful in the treatment of scabies in children, but twenty at least are requisite to effect a cure. (Rayer, *Treatise on Diseases of the Skin*, p. 346.) Lotions are sometimes made for local cutaneous affections, containing a larger quantity of the sulphuret (as an ounce to two quarts of water).

Administration.—Internally it may be administered in the dose of three or four grains gradually increased. It may be given either in solution or in the form of pill made with soap. For external use it is employed in solution in water, as already described, or in the form of ointment, composed of half a drachm of the sulphuret to an ounce of lard.

ANTIDOTES.—In the event of poisoning by this substance the antidote is a solution of chloride of soda or of chloride of lime.

Potas'sæ Bisul'phas.—Bisul'phate of Pot'ash.

HISTORY AND SYNONYMES.—The mode of preparing this salt was taught by Lowitz and Link at the latter end of the last century. The salt has had various names, such as *supersulphate of potash*, *sal enixum*, *acid vitriolated tartar*, and *sal auri philosophicum*.

PREPARATION.—It is ordered to be prepared by dissolving two pounds of the salt left after the distillation of nitric acid in four pints of boiling water, then adding one pound of sulphuric acid to it, boiling down the mixture, and setting aside to crystallize. It is also a product of various other manufactures.

PROPERTIES.—It is crystallizable, the primary form of the crystal being either a right rhombic prism, or the right rhombic octahedron. It has a very acid taste, and reacts strongly as an acid on vegetable colours, and decomposes the carbonates with effervescence. It is soluble in about twice its weight of water at 60°. By a red heat it evolves sulphuric acid, and is converted into the neutral sulphate of potash.

COMPOSITION.—It consists of—

	Eq.	Eq. Wt.	Per Cent.	Geiger.
Sulphuric Acid	2	80	54·80	54·77
Potash	1	48	32·87	32·53
Water	2	18	12·33	12·70
Crystallized Bisulphate Potash	1	146	100·00	100·00

CHARACTERISTICS.—The presence of sulphuric acid may be recognized by the chloride of barium; while the potash may be detected by the characters already mentioned for this substance. From the neutral sulphate of potash it is distinguished by its acid taste, its action on litmus and the alkaline carbonates, and by its greater solubility.

PHYSIOLOGICAL EFFECTS AND USES.—It is rarely used as a medicine. It possesses the combined properties of sulphuric acid and sulphate of potash. The excess of acid renders its local operation that of an astringent. When swallowed, it operates as a mild purgative, and may be employed in the same cases as the sulphate, over which it has the advantage of greater solubility. Conjoined with rhubarb it covers the bitter taste of the latter without injuring its medicinal properties. Dr. Barker (*Observations on the Dublin Pharmacopœia*, p. 138) says it may be used to form a cheap effervescing purgative salt, as follows:—73 grains of bisulphate of potash and 72 grains of crystallized carbonate of soda, to be separately dissolved in two ounces of water, and taken in a state of effervescence.

ADMINISTRATION.—The dose of it is from gr. x. to ʒij. properly diluted.

Potas'sæ Sul'phas.—Sul'phate of Pot'ash.

History and Synonymes.—The mode of preparing this salt was taught by Oswald Croll in 1643. It has been known by various appellations, such as *specificum purgans Paracelsi*, *Arcanum duplicatum*, *vitriolated kali*, *vitriolated tartar*, *sal polychrest* (literally signifying *salt of many uses* or *virtues*), *sal de duobus*, &c.

Natural History.—Sulphate of potash is found in both kingdoms of nature.

(*a.*) *In the inorganized kingdom.*—It has been met with in small quantities in some mineral waters of Saxony and Bohemia, in native alum, in alum-stone, and in a mineral called *polyhalite*, in which Stromeyer found no less than 27·6 per cent. of the sulphate of potash.

(*b.*) *In the organized kingdom.*—It has been found in the root of Polygala Senega, Winter's bark, the bulb of garlic, myrrh, opium, &c. The blood and urine of man also contain it.

Preparation.—It is obtained from the residuum of the distillation of nitric acid, either by igniting it in a crucible to expel the excess of sulphuric acid, as directed in the Pharmacopœia, or by saturating it with carbonate of potash.

Properties.—It crystallizes in single or double six-sided pyramids, the primary form of which is the right rhombic prism. It is hard, inodorous, has a saline bitter taste, and is unchanged by exposure to the air. When heated it decrepitates. At 60° F. it requires sixteen times its weight of water to dissolve it: it is insoluble in alcohol. It is decomposed by tartaric acid, which forms with it crystals of bitartrate of potash.

Composition.—The crystals contain no water of crystallization. They are thus composed:—

	Eq.	Eq.Wt.	Per Cent.	Wenzel.
Sulphuric Acid	1	40	45·45	45·25
Potash	1	48	54·55	54·75
Sulphate of Potash	1	88	100·00	100·00

Characteristics.—I have already mentioned these, when describing the bisulphate.

Physiological Effects.—It acts as a very mild purgative, without occasioning any heat, pain, or other symptoms of irritation. Its operation is, in fact, too mild for ordinary use.

Uses.—It is particularly serviceable as a laxative in disordered conditions of the alimentary canal, as diarrhœa and dyspepsia, in hepatic disorders, and in hæmorrhoidal affections. It is best given in combination with rhubarb. Thus, from five to ten grains of rhubarb, with from fifteen grains to two drachms of this salt, will be found to act mildly and efficiently in many cases of dyspepsia and diarrhœa. It is an excellent aperient for children. The objections to its employment are its slight solubility, and that when given in large doses to children it is apt to produce vomiting. It is useful, on account of its hardness, for triturating and dividing powders, as in the *pulvis ipecacuanhæ compositus*.

Dose.—It is given in doses of from fifteen grains to four or five drachms.

Potas'sæ Ni'tras.—Ni'trate of Pot'ash.

History.—At what time this salt became known is difficult now to determine. As it is found in various parts of the East, on the surface of the earth, it appears probable that it must have been known at a very early period. Furthermore, if the Chinese and Hindoos were acquainted with the art of making gunpowder and fireworks at a very early period of history, they must have employed, and, therefore, been acquainted with, nitre. Geber, (*Invention of Verity*) however, is the first who distinctly mentions it. But the terms *neter* of the Old Testament (*Prov.* ch. xxv. 20 ; *Jer.* ch. ii. 22), translated *nitre,—νίτρον* of Herodotus (*Euterpe*, lxxxvii.) and Theophrastus (*De Igne*)—and *nitrum*, of Pliny (*Hist. Nat.* xxx. i.), appear to have been applied either partially or exclusively to *natron* (sesqui-carbonate of soda.) (See Beckman's *History of Inventions and Discoveries*, vol. iv.) The word *saltpetre*, usually applied to nitre, is evidently derived from *sal petræ*, literally signifying rock salt.

Natural History.—This salt occurs in both kingdoms of nature.

(*a.*) *In the inorganized kingdom.*—In the East Indies, Egypt, Persia, Spain, and other parts of the world, large quantities of nitre are found in the soil. It would appear to be formed below, and to be brought to the surface of the soil by efflorescence. Some have thought that the nitric acid of the salt was formed by the union of the nitrogen and oxygen of the atmosphere, while others have supposed the presence of animal matters necessary to yield, by their decomposition, nitrogen. In some instances the latter opinion is probably correct: but it does not invariably hold good, for in a nitre cave at Ceylon, Dr. Davy (*Account of the Interior of Ceylon*) found nitre without any animal matter. The potash of the nitrate is in most cases easily accounted for, being found in some of the constituents of the soil, namely, feldspar and mica.

(*b.*) *In the organized kingdom.* This salt has been found in various plants, as in the roots of *Cissampelos Pareira*, *Geum urbanum*, &c. (Decandolle, *Phys. Végét.* p. 387.)

Preparation.—The nitrate of potash consumed in this country is imported from India, where it is obtained from natural sources. In some parts of Europe it is procured artificially.

1. *From natural sources.*—The district of Tirhût, in Bengal, is more productive of nitre than any other place in India. It is most abundant in those parts containing a redundancy of carbonate of lime. An average sample of the soil analyzed by Mr. Stevenson (*Journ. of the Asiatic Society of Bengal*, vol. ii. p. 23) gave the following composition:

Matter insoluble in three Mineral Acids	Silex	50·0
Matter soluble in ditto	Carbonate of Lime	44·3
Matter soluble in Water	Sulphate of Soda	2·7
	Muriate of ditto	1·4
	Nitrate of Lime	0·9
	Nitrate of Potash	0·7
		100·0

"In the month of November the *leonahs*, or native manufacturers of saltpetre, commence their operations, by scraping off the surface from old mud heaps, mud buildings, waste grounds, &c. where the saltpetre has developed itself in a thin white efflorescence, resembling frost rind. This saline earth being collected at the factories, the operator first subjects it to the process of solution and filtration. This is effected by a large mud filter, lined on the inside with stiff clay." It has a false bottom of bamboo, covered with close wrought grass mats, on which are placed vegetable ashes. Upon these the nitrous earth is laid. Water is then added to dissolve the saline matters of the earth, and the solution thus obtained, filtering through the mats, drops into the empty space between the real and false bottom, and is conveyed away into an earthen receiver. In its passage through the wood-ashes the carbonate of potash contained in the latter re-acts on the nitrate of lime of the solution, and produces nitrate of potash and carbonate of lime. The solution is afterwards evaporated in earthen pots, filtered, and put aside to crystallize. The impure nitre thus procured is termed *dhouah:* it contains from 45 to 70 per cent. of pure nitrate of potash. It is re-dissolved and crystallized by the native merchants, who supply the Calcutta bazaars, and when thus purified is called by the natives *kalmee.* (See Stevenson, *op. cit.*; also *India Jour. of Med. and Phys. Science*, new series, vol. i. p. 10, 1836.)

Saltpetre is imported into this country principally from Calcutta, but some comes from Madras. It is brought over in cloth bags which contain from 150 to 175 lbs. each. Its quality varies considerably. It is always more or less impure: but the common varieties, which have a dirty yellowish appearance, are termed *rough* or *crude saltpetre*, while the purer and cleaner looking kinds are called *East India refined.* The loss which it suffers in refining, or in other words the impurities which it contains, are technically designated *refraction.* This varies greatly in different samples, but is usually between 5 and 15 per cent. (For the methods of determining it, consult Dumas, *Traité de Chimie*, t. 2^me^. p. 762; and Brande's *Manual of Chemistry*, 4th ed. p. 549.)

Nitre is purified by repeated crystallization. When it has been dissolved and crystallized once only it is called *singly refined nitre:* when twice, *doubly refined.* Its purity may be ascertained by testing it with nitrate of silver, chloride of barium, and oxalate of ammonia. The first detects the chlorides, the second the sulphates, and the third the calcareous salts.

2. *From artificial sources.*—The artificial preparation of nitre is practised in several parts of Europe. The establishments in which it is carried on are called *artificial Nitrières.* The mode adopted varies, however, in different places.

At Appenzel, a canton of Switzerland, nitre is formed from the urine of animals. A hole is dug near to stables, and in this is put a sandy kind of earth, which is kept moistened with the water running from the stables. In two or three years this earth yields nitre.

In Sweden, where each landed proprietor is compelled to furnish a certain quantity of nitre, it is prepared as follows:—Decomposing animal and vegetable matters, mixed with cinders, lime, or marl, are placed in heaps (called *nitre beds*) under cover, the mass being occasionally moved, or holes made in it, so that they are exposed to the air. From time to time they are watered with urine (a liquid containing more nitrogen than any other animal substance.) At the end of two or three years the nitrogen has combined with oxygen, and this with bases to form nitrates. By lixiviation the salts may be separated, and any nitrate of lime present may be converted into nitrate of potash by adding wood-ashes, which contain carbonate of potash.

In Prussia *nitre-walls* are employed instead of nitre-beds. These have two advantages,—they economize land, and they expose a large surface to the air, (Dumas, *op. cit.*)

PROPERTIES.—Nitrate of potash usually crystallizes in six-sided prisms with diëdral summits. Its primitive form is the right rhombic prism, and, therefore, it has two axes of double refraction along which a ray of light is not split into two.

Double system of rings seen by looking through a slice of nitre (cut perpendicularly to the axis of the crystal) placed between two plates of tourmaline (cut parallel to the axis of the crystal).

FIG. 52. FIG. 53.

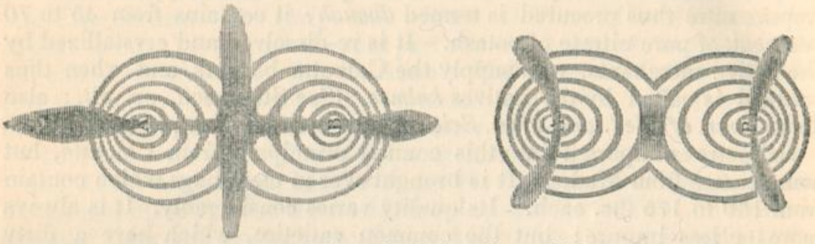


Fig. 52 is seen when the plane of the axis of nitre is parallel or perpendicular to the plane of polarization.—Fig. 53 is seen when the nitre is turned 45°.

When pure the crystals are transparent and colourless, have a sharp cooling taste, and undergo no change by exposure to the air. When heated, nitrate of potash fuses, and when cast in moulds forms the *nitrum tabulatum*, or *sal prunelle* of the shops. At a strong red heat it is decomposed, with the evolution of oxygen and the formation of hyponitrite of potash, which when rubbed to powder and mixed with sulphuric acid emits red fumes (composed of nitrous acid and binoxide of nitrogen.) One hundred parts of water at 32° dissolve 13·32 parts of this salt, but at 77° they dissolve 38 parts. During the solution cold is generated. In pure alcohol nitre is insoluble.

COMPOSITION.—Nitrate of potash has the following composition :—

	Eq.	Eq.Wt.	Per Cent.	Wollaston.			Eq.	Eq.Wt.	Per Cent.
Nitric Acid	1	54	52·9	53·332	or	Nitrogen	1	14	13·75
Potash	1	48	47·1	46·668		Oxygen	6	48	47·10
						Potassium	1	40	39·15
Nitrate of Potash	1	102	100·0	100·000			1	102	100·00

The crystals contain interstitial water, but no water chemically combined.

CHARACTERISTICS.—This salt is known to be a nitrate by the characters already detailed (p. 160) for this class of salts. That its base is potash is shewn by the tests before mentioned (p. 274) for this substance.

PHYSIOLOGICAL EFFECTS. (*a.*) *On vegetables.*—Nitrate of potash dissolved in 300 times its weight of water promotes vegetation : but a solution containing $\frac{1}{30}$ part of nitre is injurious to the growth of plants (Davy, *Agricult. Chemistry*).

(*b.*) *On animals generally.*—Orfila (*Toxicol. Gén.*) found that introduced into the stomach of dogs it acts as an irritant poison, and is capable of producing death, when it is not vomited, in doses of two or three drachms. Its operation is that of a narcotico-acrid poison. When applied to the cellular tissue it produces, according to this experimentalist, local effects only, and does not become absorbed. But Devergie (*Méd. Lég.*) states on the authority of J. E. M. Smith, that half an ounce applied to the thigh killed a dog in thirty-six hours. Eight ounces dissolved in a pint of water, and swallowed, killed a horse in twenty-four hours with all the symptoms of violent intestinal irritation, (Moiroud, *Pharm. Vétér.*) Veterinarians use nitre as a diuretic and refrigerant in doses of from two to four drachms.

(*c.*) *On man.*—In *very large doses* (such, for example, as one ounce or more) nitre has in several instances caused death; but the effects of it are not uniform, since, in other cases, this quantity has not appeared to have any very remarkable or obvious effect. For example, Dr. Christison knew an instance in which one ounce was taken without occasioning any other unpleasant symptom than vomiting; and it was retained on the stomach for above a quarter of an hour. In those cases where violent effects followed the ingestion of it, the symptoms were twofold: on the one hand, those indicating inflammation of the alimentary canal (such as pain, vomiting, and purging;) on the other hand, an affection of the nervous system (marked by giddiness, convulsions, failure of pulse, tendency to fainting, dilated pupil, insensibility, and palsy.) It is probable that the operation of nitre is influenced by the quantity of aqueous liquid in which the salt was dissolved, and that the more we dilute, the less powerfully does it act as a poison. In no other way can we reconcile the discrepant statements in regard to the effects produced by an ounce of nitre.

If nitre (or any other neutral alkaline salt) be mixed with dark-coloured venous blood out of the body, it communicates to it a florid or arterial hue. Now as this salt, when taken into the stomach becomes absorbed, it is not unreasonable to suppose that while mixed with the circulating blood it might have an analogous effect. Dr. Stevens (*Observations on the Blood*, p. 298) asserts, that in the last stage of fever, when the blood is black, it has this effect. Moreover, he tells us (p. 154) that in a case which occurred in America, where a person swallowed an ounce of nitre, by mistake, in place of Glauber's salts, the blood when drawn from a vein was completely florid, and remained as fluid as if the nitre had been added to it out of the body. (For some remarks on the effects of nitre on the blood, by Mr. Carlyon, see *Med. Gaz.* vol. viii. p. 626; and on nitre as a therapeutic agent, by Dr. Hancock, see *Lancet* for 1831-2, vol ii. p. 766.)

In *moderate doses* nitre acts as a refrigerant, diuretic, and diaphoretic. Its refrigerant properties are best seen when the body is preternaturally hot, as in febrile disorders. Mr. Alexander (*Essays*, pp. 105, *et. seq.*) in his trials with it, made on himself, experienced a sensation of chilliness after each dose, but he could not recognise by the thermometer any diminution of heat in the external parts of his body. He found in most of his experiments that it had a powerful influence over the vascular system, and surprisingly diminished, in a very short period of time, the number of pulsations. Thus on several occasions a drachm of this salt, within a few minutes, reduced the frequency of his pulse from 70 to 60 beats. Sundelin (*Heilmittell.* Bd. i. S. 59) says nitre diminishes the orgasm and plasticity of the blood perhaps by a chemical action on the cruor and fibrin. Diuresis is another, and very generally observed effect. As the nitre can be detected in the urine, its operation as a diuretic depends perhaps on the local stimulus which is communicated to the renal vessels while the nitre is passing through them. Like most of the neutral salts of the alkalies, the continued use of it promotes alvine evacuations. Full doses frequently produce pain in the stomach. As a diaphoretic it is usually given in combination with emetic tartar.

USES.—It follows from what has been now stated in regard to the physiological effects of nitre, that this substance is indicated when we wish to diminish preternatural heat, and to reduce the force and frequency of the pulse, as in febrile disorders, inflammatory affections (except perhaps those of the stomach, bowels, kidneys, and bladder), and hæmorrhages (especially hæmoptysis.) In continued fever it is frequently given in combination with emetic tartar, and sometimes also with calomel. It is not often used as a diuretic, because its activity in this respect is not very great, but it is adapted for those cases which are accompanied with arterial excitement. In sore throat it is mixed with white sugar and gradually swallowed. A mixture of nitre and powdered gum has long been a favourite remedy for diminishing the scalding of gonorrhœa. Nitre is rarely employed as an external agent, except as a means of producing cold. Thus five ounces of nitrate of potash, with five ounces of muriate ammonia, dissolved in sixteen ounces of water, will reduce the temperature 40° F.; that is, from 50° to 10°, according to Mr. Walker. Hence, therefore, we sometimes employ this mixture, placed in a bladder, as an external application (see p. 133.)

On the belief that fever, cholera, and other malignant diseases, were produced by a deranged state of the blood, and that this derangement depended on, or consisted in, a diminution or entire loss of the saline parts of the blood, Dr. Stevens employed nitre, chloride of sodium, and other alkaline salts, in the treatment of these diseases (see his *Observations*, pp. 296, 298, &c.) Nitre in large doses has been employed in the treatment of scurvy, and with considerable success, according to the statement of Mr. Cameron (*Medico-Chirur. Review*, March 1830, p. 483.)

ADMINISTRATION.—It may be given in doses of from ten grains to half a drachm in the form of powder mixed with sugar, or in solution. If administered as a refrigerant, it should be dissolved in water and immediately swallowed, in order that the coldness of the solution may assist the action of the salt. If employed as a diuretic, we ought to give liquids plentifully, and keep the skin cool.

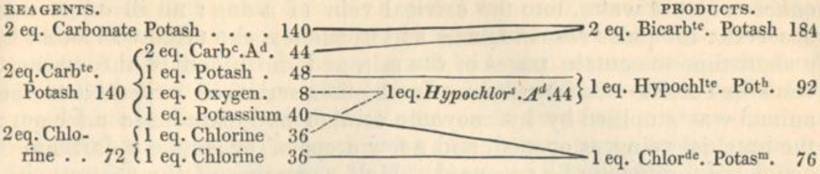
ANTIDOTE.—No chemical antidote is known for this salt. In case of poisoning, therefore, we should remove the poison from the stomach as speedily as possible, and administer tepid emollient drinks. Opiates perhaps may be advantageously administered. The inflammatory symptoms are to be combated by the usual antiphlogistic measures.

Potas'sæ Chlo'ras.—Chlo'rate of Pot'ash.

HISTORY.—Chlorate of potash (also called *oxymuriate* or *hyperoxymuriate of potash*) was first procured by Mr. Higgins, who seems to have confounded it with nitrate of potash. In 1786 it was distinguished by Berthollet.

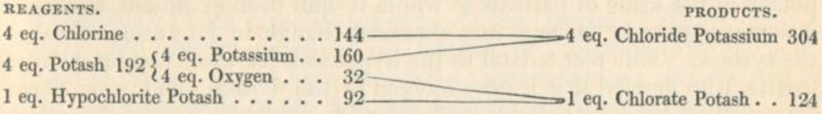
PREPARATION.—It is prepared by passing chlorine gas slowly through a cold solution of carbonate of potash placed in a Woulfe's bottle. The liquid is allowed to stand for twenty-four hours in a cool place, and is then found to have deposited crystals of chlorate of potash. These are to be drained, washed with cold water, dissolved in hot water, and recrystallized.

When chlorine gas comes in contact with a solution of carbonate of potash, three salts are formed: chloride of potassium, hypochlorite of potash, and bicarbonate of potash.



In proportion as the quantity of chlorine increases, the bicarbonate becomes decomposed: carbonic acid is evolved, and a further quantity of hypochlorite of potash and chloride of potassium is produced.

When the solution is strongly charged with hypochlorite, the action of the chlorine on the potash is somewhat changed: it abstracts the potassium from the potash, and thereby forms chloride of potassium, while the oxygen thus set free combines with some hypochlorite of potash, and thereby converts it into the chlorate, the greater part of which crystallizes.



The residual liquor contains a little chlorate, and a considerable quantity of hypochlorite of potash and chloride of potassium (Souberain, *Pharmacie*, t. 2^{me}. p. 430.)

PROPERTIES.—Chlorate of potash crystallizes in nearly rhomboidal plates, the primary form of which is an oblique rhombic prism. Its taste is cool, and somewhat similar to nitre. When rubbed in the dark it becomes luminous. 100 parts of water at 32° F. dissolve 3·5 parts of chlorate: at 59° F. 6 parts: at 120° F. 19 parts.

CHARACTERISTICS.—This salt is known to be a chlorate by the following characters:—When heated, it fuses, gives out oxygen, and is converted into chloride of potassium: when thrown on a red-hot coal, it deflagrates—a property, however, common to several other salts. Sulphuric acid gives it an orange red colour, evolves the chlorous acid (peroxide of chlorine), known by its yellow colour, and great explosive power when heated. Rubbed with sulphur or phosphorus it explodes violently. Mixed with hydrochloric acid and then with water, it forms a bleaching liquid. The base of the salt is known by the tests for potash, already mentioned.

COMPOSITION.—It is an anhydrous salt.

	Eq.	Eq.Wt.	Per Cent.	Berzelius.
Chloric Acid	1	76	61·30	61·5083
Potash	1	48	38·70	38·4917
Chlorate of Potash	1	124	100·00	100·0000

IMPURITY.—Chloride of potassium is the usual impurity. This may be detected by a solution of nitrate of silver producing the white chloride of silver. The pure chlorate potash produces no obvious change in nitrate of silver.

PHYSIOLOGICAL EFFECTS. (*a.*) *On animals generally.*—In one series of experiments, Dr. O'Shaughnessy (*Lancet* for 1831-2, vol. i. p. 369,) injected from 10 to 60 grains of chlorate of potash, dissolved in three ounces of tepid water, into the cervical vein of a dog: no ill effect was observed: the pulse rose in fulness and frequency, the urine was found in a short time to contain traces of the salt, and the blood of the tracheal veins had a fine scarlet colour. In another series of experiments the animal was stupified by hydrocyanic acid or hydrosulphuric acid gas: the brachial vein was opened, and a few drops of excessively dark blood could with difficulty be procured. Half a drachm of the chlorate dissolved in water of the temperature of the blood was injected slowly into the jugular vein: the pulsation of the heart almost immediately began to return, and in the course of eight minutes scarlet blood issued from the divided brachial veins. In twenty minutes the animal was nearly recovered, and passed urine copiously, which was found to contain the chlorate.

(*b.*) *On man.*—The action of this salt on man requires further investigation. It appears to be refrigerant and diuretic, analogous to that of nitrate of potash. Wöhler and Stehberger have recognized chlorate of potash in the urine of patients to whom it had been exhibited, so that it does not appear to undergo any chemical change in its passage through the system. This fact is fatal to the hypothesis of the chemico-physiologists, who fancied that it gave oxygen to the system, and was, therefore, well adapted for patients affected with scorbutic conditions, which were supposed to depend on a deficiency of this principle. Excessive doses of the chlorate, like those of the nitrate, would probably produce an affection of the nervous system; but I am not acquainted with any satisfactory case in proof. Duchateu (Merat and De Lens, *Dict. Mat. Méd.*) says that eighteen grains taken at thrice caused convulsions and delirium; but the observation is probably erroneous: for others have not experienced these effects, in much larger doses. Dr. Stevens (*On the Blood*, p. 155) says chlorate of potash gives a beautiful arterial colour to the venous blood, and reddens the gums much faster than mercury.

USES.—Chlorate of potash was originally employed as a medicine for supplying oxygen to the system, where a deficiency of that principle was supposed to exist. With this view it was successfully administered by Dr. Garnett (Duncan's *Annals of Medicine*, 1797) in a case of chronic scorbutus. Dr. Ferriar also tried it in scurvy with success (*Med. Hist. and Reflect.* vol. iii. p. 250). It was subsequently applied in the venereal disease and liver complaints as a substitute for mercurials, whose beneficial effects were thought to depend on the oxygen which they communicated to the system (see the reports of Mr. Cruikshank and Dr. Wittman, in Dr. Rollo's *Cases of Diabetes Mellitus*, 2d ed. pp. 504 and 563: also Dr. Chisholm's letter in the same work, *Preface*, p. x). It has also been tried in cases of general debility, on account of its supposed tonic effects, but failed in the hands of Dr. Ferriar (*op. cit.*). In a case of dropsy under the care of the latter gentleman it operated successfully as a diuretic. More recently, it has been used by Dr. Stevens (*On the Blood*, p. 296) and others, as a remedy for fever, cholera, and other malignant diseases, which, he supposed, depend on a deficiency of saline matters in the blood, but as it was usually employed in conjunction with chloride of sodium (see the article on this salt, further on) and carbonate of soda, it is impossible to determine what share the chlorate had in producing the beneficial effects said to have been obtained by what is called the *saline* treatment of these diseases.

It appears, then, that all the uses of this salt have been founded on certain views of chemical pathology, some of which are now considered untenable. It is very desirable, therefore, that some person, unbiassed by theoretical opinions, would carefully investigate its effects and uses, which I am inclined to think have been much overrated.

Administration.—The usual dose of it is from ten or fifteen grains to half a drachm. Dr. Wittman, in one case, gave 160 grains daily, with a little hydrochloric acid immediately after it, to decompose it: the effects were hot skin, headache, quick, full, and hard pulse, white tongue, and augmentation of urine.

Potas'sæ Car'bonas.—Car'bonate of Pot'ash.

History.—It is probable that the ancient Greeks, Romans, and Egyptians, were acquainted with this salt. Pliny (*Hist. Nat.* lib. xiv. and xxviii.) describes some of the uses of wood-ashes, and mentions a lye of them (*cineris lixivium*). For a long period carbonate of potash was confounded with carbonate of soda. Geber (*Invent. of Verity*, ch. iv.), in the eighth century, describes the method of procuring it by the combustion of tartar. It has been known by various names; such as, *salt of tartar*, *mild vegetable alkali*, *fixed nitre*, and *subcarbonate of potash*.

Natural History.—Reuss (Gairdner, *On Mineral Springs*, p. 18) found carbonate of potash in the waters of the Wuissokow, and in the chalybeate of Twer.

It is formed, during the combustion of inland plants, by the decomposition of the vegetable salts of potash (the acetate, the malate, and the oxalate, but principally the first). Hence it is procured in great abundance from wood-ashes. In some few cases it has been supposed to exist ready formed in plants, as in a fern referred to by Mr. Parkes (*Chemical Essays*, vol. ii. p. 17), the expressed juice of which is employed by the poor weavers of Yorkshire, in the cleansing of cloth at the fulling mills.

Preparation.—It is principally obtained from *wood-ashes* (*cineres vegetabilium*, seu *cineres e lignis combustis*). These are procured by burning wood piled in heaps on the ground, sheltered from the wind, or in pits.—[For an account of the proportion and composition of wood-ashes, see Berthier, *Traité des Essais*, t. 1er. p. 259).] The soluble constituents of the ashes are, carbonate, sulphate, phosphate, and silicate of potash, and chlorides of potassium and sodium. The insoluble constituents are, carbonate and subphosphate of lime, alumina, silica, the oxides of iron and manganese, and a dark carbonaceous matter. In America the ashes are lixiviated in barrels with lime, and the solution evaporated in large iron pots or kettles, until the mass has become of a black colour, and of the consistence of brown sugar. In this state it is called by the American manufacturers *black salts* (*cineres clavellati crudi*). The dark colour is said by Dumas to be owing to ulmate of potash.

To convert this substance into the *pot-ash* of commerce (*cineres clavellati calcinati*), it is heated for several hours, until the fusion is complete, and the liquid becomes quiescent. It is then transferred by large iron ladles into iron pots, where it congeals in cakes. These are broken up, packed in tight barrels, and constitute the pot-ashes of commerce. Its colour varies somewhat, but it is usually reddish, in consequence of the presence of sesquioxide of iron.

To make the substance called *pearl-ash* (*potassa impura*, Ph. L.) the mass called black salts, instead of being fused, is transferred from the kettles to a large oven-shaped furnace, so constructed that the flame is made to play over the alkaline mass, which in the meantime is stirred by means of an iron rod. The ignition is in this way continued until the combustible impurities are burnt out, and the mass, from being black, becomes dirty bluish white: this is pearl-ash (*United States Dispensatory*). The colouring matter is probably manganesiate of potash.

The following table shows the composition of various kinds of pot-ash and pearl-ash, according to Vauquelin (*Ann. de Chim.* xl. 273):—

Kinds of Potash.	Caustic Hydrate of Potash.	Sulphate of Potash.	Chloride of Potassium.	Insoluble residue.	Carbonic Acid and Water.
American Potash . .	857	154	20	2	119
Russian Potash. . .	772	65	5	56	254
American Pearlash .	754	80	4	6	308
Potash of Trèves . .	720	165	44	24	199
Dantzic Potash . . .	603	152	14	79	304
Potash of Vosges . .	444	148	510	34	16

In this table it will be observed, that the American pot-ash contains the largest quantity of caustic potash: this arises, probably, from the use of lime in its manufacture. Moreover, pearl-ash contains more carbonate of potash than pot-ash: this must arise from the absorption of carbonic acid during its preparation.—[For the mode of estimating the quantity of alkali present, see Mr. Faraday's *Chemical Manipulation*, art. *Alkalimetry*.] The pot-ash and pearl-ash employed in this country are principally imported from the British North American colonies, from Russia, and from the United States of America.

In the Pharmacopœia carbonate of potash is directed to be prepared as follows:—Dissolve two pounds of impure carbonate of potash (pearl-ash) in a pint and a half of water, and strain; then pour it off into a proper vessel, and evaporate the water, that the liquor may thicken; then stir it constantly with a spatula until the salt concretes. In this process the earthy impurities insoluble in water are got rid of. The same authority also states, that a purer carbonate may be prepared by heating the crystals of the bicarbonate to redness.

The high price of pearl-ash has occasionally led to the manufacture of carbonate of potash from *sal enixum* (bisulphate of potash), by heating it in a reverberatory furnace with charcoal. This yields sulphuret of potassium, in consequence of the carbon deoxidizing the bisulphate. By roasting, the sulphuret is decomposed, and converted into the carbonate of potash; the sulphur being dissipated, and the potassium combining with oxygen and carbonic acid.

PROPERTIES.—Carbonate of potash (the *salt of tartar* of the shops) is usually kept in a granular condition, on account of the difficulty of crystallizing it. It is white, inodorous, and strongly alkaline to the taste. It reacts powerfully as an alkali on turmeric or infusion of red-cabbage. It is fusible at a red heat; has a strong affinity for water, so that by exposure to the air it attracts water, and becomes liquid, forming the *oleum tartari per deliquium*. It is insoluble in alcohol, but is very soluble in water; and in the Pharmacopœia is an officinal solution, called *liquor potassæ carbonatis*, composed of twenty ounces of the salt dissolved in a pint of distilled water. The solution is colourless, inodorous, and has a sp. gr. of 1·473.

Pure carbonate of potash may be prepared by the combustion of bitartrate of potash and nitre (forming what is called *white flux*), lixiviating, concentrating by evaporation, and crystallizing. The primary form of the crystal is a rhombic octahedron.

Characteristics.—It is known to be a carbonate by its effervescing with the strong acids, and by a solution of it causing a white precipitate (soluble in acetic acid) with lime water or with chloride of barium. That it is a potash salt is determined by the tests for potash already mentioned. From the bicarbonate of potash it is distinguished by its causing a brick-red precipitate with a solution of bichloride of mercury, the precipitate being percarbonate of mercury. Sulphate of magnesia produces a white precipitate with the carbonate of potash, and not with the bicarbonate. This test, however, will not recognise the carbonate when mixed with a large quantity of bicarbonate.

Composition.—Mr. Phillips (*Pharmacopœia*) says, one hundred parts of the carbonate of potash of the shops loses about 16 parts of water when heated to redness. Hence supposing the carbonate to have been pure (which that of commerce never is) its composition would be as follows:—

	Eq.	Eq.Wt.	Per Cent.
Potash	1	48	57·6
Carbonic Acid	1	22	26·4
Water	1½	13·5	16·0
Pure Granulated Carb. Potash	1	83·5	100·0

The pure crystallized salt contains two equivalents of water of crystallization, and its equivalent weight, therefore, is 88.

Impurities.—The ordinary impurities in this salt are silicic acid, the chlorides, and sulphates. The first is detected by supersaturating with hydrochloric acid, evaporating, and igniting the residue: the silicic acid is insoluble in water. The other impurities are detected by supersaturating the salt with nitric acid: if the resulting solution give a white precipitate with nitrate of silver, the presence of chloride is to be inferred: if it produce a white precipitate with chloride of barium, a sulphate is present.

Physiological Effects.—Its effects are in *quality* precisely those of caustic potash already described, but their *intensity* is much less, on account of the presence of carbonic acid, which diminishes the alkaline properties of the base. When it is taken into the stomach in large quantities, it acts as a powerfully caustic poison, sometimes inducing death in twelve hours, and producing symptoms similar to those caused by the mineral acids: at other times, however, the patient recovers from the immediate effect of the alkali, but in consequence of the altered condition of the alimentary canal the assimilative process cannot be carried on; and after dragging on a miserable existence for a few weeks, the unfortunate sufferer dies of absolute starvation. And lastly, in some cases, the caustic operation of the poison is principally confined to the œsophagus, causing stricture and death. In one case, related by Sir Charles Bell (*Surgical*

Observations, part i. p. 82), a patient swallowed soap lees: this produced inflammation, which terminated in stricture. She lingered for 20 years, and died literally starved. Several other cases have been detailed. (Christison, *On Poisons.*) A weak solution of carbonate of potash produces no change in the sanguineous particles drawn from the body: a saturated solution slightly and gradually diminishes their size.

USES.—This salt is employed in medicine in most of the cases already mentioned when describing the uses of caustic potash. For example, as an antacid in dyspeptic affections; as a diuretic; as an antacid in that form of lithiasis which is accompanied with an increased secretion of lithic acid, or the lithates; in those forms of inflammation in which there is a tendency to the formation of false membranes; in gout, &c. Mixed with cochineal it is a popular remedy for hooping-cough. Externally, it has been applied in the form of a solution to wounds; as an injection in gonorrhœa; as a collyrium in some affections of the cornea, &c. Lastly, it is sometimes employed in the manufacture of the common effervescing draught, made with either the citric or tartaric acid. Twenty grains of carbonate of potash are saturated by about 17 grains of the citric acid of commerce, by 18 grains of tartaric acid, or by ʒiv. of lemon juice.

ADMINISTRATION.—It may be given either in the solid or liquid state. In the solid state it is given in doses of from gr. x. to ʒss. The doses of the *liquor potassæ carbonatis* of the Pharmacopœia is from ten minims to a fluidrachm.

ANTIDOTES.—When swallowed as a poison, the antidotes are oils or acids, as already mentioned for the caustic potash.

Potas'sæ Bicar'bonas.—Bicar'bonate of Pot'ash.

HISTORY.—This salt, formerly called *carbonate of potash* or *aerated kali*, was first prepared by Cartheuser in 1752.

PREPARATION. (*a.*) *Process of the Pharmacopœia.*—In the London Pharmacopœia we are directed to pass carbonic acid (generated by the action of equal weights of sulphuric acid and water in powdered chalk), through a solution of six pounds of the carbonate in a gallon of distilled water, to saturation. Apply a gentle heat, so that whatever crystals have formed may be again dissolved. Then set the solution aside that crystals may be formed, which are to be dried.

In this process, each equivalent of carbonate of potash unites with an additional equivalent of carbonic acid, and thereby forms the bicarbonate. The silicic acid is separated partly while the carbonic acid is passing through the solution, and partly during the crystallization of the bicarbonate.

(*b.*) *Cartheuser's Process.*—In the *Pharmacopée Raisonnée* of MM. Henry and Guibourt the following directions are given for performing this process:—Dissolve 500 parts of (pure) carbonate of potash in 1000 parts of distilled water, and filter: place the solution in a porcelain capsule in a salt-water bath, and gradually add 300 parts of pulverized carbonate of ammonia: slightly agitate the liquor until only a feeble disengagement of ammonia is perceived, then filter over a heated vessel, and put aside to cool. The proportions employed by Geiger (*Handbuch. d. Pharm.*) are somewhat different: they are, a pound of carbonate of potash, sixteen ounces of water, and six ounces of carbonate of ammonia. Mr. Brande (*Manual of Chemistry*) says Cartheuser's process is more expensive than that of the Pharmacopœia.

In this process the volatility of the ammonia, joined to the affinity of the carbonate of potash for more carbonic acid, causes the decomposition of the sesquicarbonate of ammonia: the ammonia with a small portion of carbonic acid is disengaged, while the remaining acid converts the carbonate into the bicarbonate of potash.

PROPERTIES.—It is a crystalline, colourless solid, the primary form of whose crystal is, according to Mr. Brooke, a right oblique-angled prism. It is inodorous, has an alkaline taste, and re-acts very feebly as an alkali on vegetable colours. It is soluble in four times its weight of water, at 60° F., but is insoluble in alcohol. When exposed to the air it undergoes no change. When exposed to a red heat it gives out half its carbonic acid, and becomes the carbonate.

CHARACTERISTICS.—The presence of carbonic acid and potash in this salt is known by the tests for these substances before mentioned. From the carbonate of potash it is best distinguished by a solution of bichloride of mercury, which causes a slight white precipitate with it: whereas with the carbonate it causes a copious brick-dust precipitate. Sulphate of magnesia will not recognise the freedom of bicarbonate from carbonate, as I have before stated (p. 301.)

COMPOSITION.—The composition of this salt is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Berard.
Potash	1	48	47·58	48·92
Carbonic Acid	2	44	43·60	42·01
Water	1	9	8·82	9·07
Crystallized Bicarbonate Potash	1	101	100·00	100·00

IMPURITIES.—The presence of chlorides and sulphates may be recognized in the way described when speaking of carbonate of potash. Bichloride of mercury may be employed to detect any carbonate of potash, with which it would form a brick-dust coloured precipitate.

PHYSIOLOGICAL EFFECTS.—The effects of this salt are similar to those of the carbonate of potash, except that its local action is much less energetic, in consequence of the additional equivalent of carbonic acid; while the alkaline effect on the system is equally energetic, so that it is an exceedingly eligible preparation in lithiasis and other cases where we want its constitutional, and not its local, action.

USES.—It may be employed for the same purposes that we use caustic potash (vide *potash*), except that of acting as an escharotic. Thus it is used as an antacid, to modify the quality of the urine, in plastic inflammation, in glandular diseases, affections of the urinary organs, &c. But its most frequent use is that for making effervescing draughts, with either citric or tartaric acid. The proportions are as follows:—20 grains of bicarbonate of potash will saturate about 14 grains of the citric acid of commerce, 15 grains of tartaric acid, or ʒiijss. of lemon juice. In the shops, a preparation, called *lemon and kali*, is kept: it is composed of sugar, dry citric acid, and the bicarbonate of potash. It is used as an extemporaneous effervescing draught. As it abstracts water from the atmosphere, it must be kept in a well-stopped bottle.

Where there is great irritability of stomach, I believe the effervescing draught, made with bicarbonate of potash and citric acid, to be more efficacious than that made with carbonate of soda and tartaric acid, the resulting citrate of potash being, in my opinion, a much milder preparation than the tartrate of soda. The citrate promotes slightly the secretions of the alimentary canal, the cutaneous transpiration, and the renal secretion: and like other vegetable salts of potash, renders the urine alkaline.

Administration.—This salt may be given in doses of from gr. x. to gr. xv. or to the extent of half a drachm, or even a drachm.

Liquor Potassæ Effervescens (Ph. L.)—The effervescing solution of (bicarbonate of) potash is ordered to be prepared by dissolving a drachm of bicarbonate of potash in a pint of water, and passing into the solution carbonic acid compressed by force, more than sufficient for saturation. The solution is to be kept in a well-stopped vessel. This preparation has been introduced as an agreeable form for exhibiting carbonate of potash, without diminishing its constitutional operation.

Potas'sæ Ace'tas.—Ac'etate of Pot'ash.

History.—It appears to have been first clearly described by Raymond Lully in the thirteenth century, and has been known by several appellations, such as *terra foliata tartari, diuretic salt*, &c.

Natural History.—Geiger (*Handbuch der Pharmacie*) says this salt is found in some mineral springs. It probably exists in most plants which, by incineration, yield carbonate of potash. The sap of the elm and of most trees, Winter's bark, linseed, senna leaves, the rhizome of ginger, &c. are said to contain it.

Preparation.—It is prepared by adding a pound of carbonate of potash to twenty-six fluidounces of acetic acid (Ph. L.) mixed with twelve fluidounces of distilled water, or sufficient acid to saturate the carbonate. Evaporate the strained liquor in a sand-bath, the heat being cautiously applied until the salt is dried.

In this process the acid unites with the potash of the carbonate, and disengages carbonic acid.

Properties.—It is usually met with as a colourless, white solid, with a foliated texture (which is given to it by fusion and cooling), odourless, but having a pungent saline taste, and a soapy feel. It is exceedingly deliquescent, and, therefore, ought to be preserved in a well-stopped bottle. It is very soluble both in water and alcohol; indeed, in water, it is one of the most soluble salts we are acquainted with. At 60°, 100 parts of the salt will dissolve in 102 parts of water. When heated, it fuses and is decomposed into *pyroacetic spirit*, and *carbonate of potash*. One equivalent of this spirit contains the elements of one equivalent of acetic acid, minus those of one equivalent of carbonic acid.

Characteristics.—(See the tests for the *acetates*, p. 222, and for *potash*, p. 274).

Composition.—Its composition is as follows :—

	Eq.	Eq. Wt.	Per Cent.	Wenzel.
Potash	1	48	48·5	50·15
Acetic Acid (dry)	1	51	51·5	49·85
Acetate of Potash	1	99	100·0	100·00

Purity.—It should be white and perfectly neutral. Frequently, however, it reacts as an alkali, owing to a slight excess of potash. The presence of chlorides may be detected by nitrate of silver; of sulphates, by chloride of barium; of metals, by hydrosulphuric acid or ferrocyanide of potassium.

PHYSIOLOGICAL EFFECTS.—Two or three drachms cause purging, which is sometimes accompanied with griping. In smaller doses, more especially if largely diluted, this salt acts as a mild diaphoretic. In its passage to the kidneys it becomes decomposed, and converted into the carbonate of potash, which may be detected in the urine. Probably the pulmonary excretions of those who employ it also become impregnated with this salt, since it has been said that in persons with delicate lungs it acts as an irritant to these organs.

USES.—In this country it is rarely employed, except as a diuretic in dropsical complaints. On the continent, however, it is administered in various other diseases, as an alterative or resolvent, in scirrhus of the pylorus, chlorosis, and visceral and glandular enlargements. It may be employed, in the lithic acid diathesis, to render the urine alkaline. It is of course exceedingly improper where phosphatic deposits are observed in the urine.

ADMINISTRATION.—It is given as a diuretic in doses of from a scruple to a drachm and a half, dissolved in some mild diluent. In larger doses, as two or three drachms, it acts as a purgative.

Potas'sæ Bitar'tras.—Bitar'trate of Pot'ash.

HISTORY.—In its impure form, as a deposit from wine, it must have been known at a very early period. "It is called *tartar*," says Paracelsus, "because it produces oil, water, tincture, and salt, which burn the patient as *hell* does." Scheele, in 1769, first explained its nature. Its synonymes are *cream of tartar*, *supertartrate of potash*, and *acidulous tartrate of potash*.

NATURAL HISTORY.—It is a constituent of many vegetables: thus it is found in grapes, tamarinds, *Cetraria islandica*, &c.

PRODUCTION.—All the bitartrate of commerce is obtained during the vinous fermentation. It exists in solution in grape juice; but being very slightly soluble in a mixture of alcohol and water, it deposits during fermentation (that is, when alcohol is produced), and forms a crust on the sides of the cask. In this state it is known in commerce under the name of *crude tartar* (*tartarus crudus*), or *argol*, and which is termed *white* or *red* (*tartarus albus* vel *tartarus ruber*), according as it is obtained from white or red wine.

Argol, or *crude tartar*, occurs in crystalline cakes of a reddish colour, and is composed of the bitartrate of potash, tartrate of lime (and sometimes racemate of potash), colouring and extractive matter, &c.

At Montpelier, bitartrate of potash is procured thus:—Argol is boiled in water, and the solution allowed to cool, by which a deposit of crystals is obtained; these are washed with cold water, and dissolved in boiling water, containing charcoal and alumina (clay); the latter substances being employed to remove the colouring matter with which they precipitate. The clear liquor is allowed to cool slowly, by which crystals of the bitartrate are formed. These constitute the *tartarus depuratus* or *crystalli tartari* of the older chemists. If a hot saturated solution of tartar be cooled, the surface of the liquid becomes coated by a layer of very fine crystals of bitartrate: hence this crust was called *cream of tartar* (*cremor tartari*.)

PROPERTIES.—As met with in commerce, this salt forms a white crystalline mass, without odour, but having an acidulous and gritty taste. The primary form of the crystals is a right rhombic prism. It is unaltered by exposure to the air; but when heated, it decomposes, swells up, evolves various volatile products, gives out an odour of caromel, and is converted into *black flux* (*fluor niger*),—a compound of charcoal and carbonate of potash. If the bitartrate be deflagrated with nitrate of potash, the residue is *white flux* (*fluor albus*), or carbonate of potash. Bitartrate of potash is very slightly soluble in water, and is insoluble in alcohol.

CHARACTERISTICS.—One character of this salt is derived from the phenomena attending its conversion into black flux, as above mentioned. If black flux be digested in water we obtain a solution of carbonate of potash, known by the properties before mentioned (p. 301.) Another character of the bitartrate is its slight solubility in water, and the solution reddening litmus. The addition of caustic potash increases its solubility, whereas alcohol diminishes it. Acetate of lead added to a solution of the bitartrate forms a copious white precipitate; lime water has the same effect. Mixed with alkaline carbonates it produces effervescence. Boracic acid, or borax, very much increases the solubility of this salt in water, forming what has been termed *soluble cream of tartar* (*cremor tartari solubilis*), or *tartarus boraxatus* of some writers.

COMPOSITION.—Crystallized bitartrate of potash has the following composition :—

	Eq.	Eq.Wt.	Per Cent.	Berzelius.
Potash	1	48	25·3	24·80
Tartaric Acid	2	132	70·0	70·45
Water	1	9	4·7	4·75
Crystallized Bitar^{te}. Potash	1	189	100·0	100·00

IMPURITY.—Bitartrate of potash usually contains from 2 to 5 per cent. of tartrate of lime, and hence a little carbonate of lime may be detected in black flux. This is of no material consequence in a medicinal point of view. If the powdered bitartrate be adulterated with either alum or bisulphate of potash, the fraud may be detected by chloride of barium, which causes a white precipitate (sulphate of baryta) insoluble in nitric acid.

PHYSIOLOGICAL EFFECTS.—When taken in *small doses*, diluted with water, it acts as a refrigerant and diuretic: in *larger doses* (as two or three drachms) it purges, and frequently creates flatulence and griping. By continued use it disorders the digestive functions, and causes emaciation, most probably from defective nutrition. In *excessive doses* it produces inflammation of the stomach and intestines. A fatal case has been recorded by Mr. Tyson (*Med. Gaz.* vol. xxi. p. 177.) A man, to relieve the effects of drunkenness, swallowed four or five table-spoonfuls of cream of tartar. It caused violent vomiting and purging, and other symptoms of gastro-enteritis, and pain in the loins. The thighs and legs appeared paralyzed. He died on the third day. On a post-mortem examination the stomach and intestines were found inflamed.

USES.—Bitartrate of potash is frequently employed in the form of *imperial* or *cream of tartar whey*, as a *refrigerant* drink in febrile and inflammatory diseases. It allays thirst, diminishes preternatural heat, and reduces vascular action. As a *diuretic* in dropsical complaints it is used in the same way. As a *purgative* it is not usually exhibited alone, but, in general, with jalap, sulphur, senna, or some other purgative. Thus, in dropsical complaints, a very valuable hydragogue cathartic is a mixture of jalap and bitartrate of potash. In skin diseases and affections of the rectum (as piles, stricture, and prolapsus) a very useful purgative is an electuary composed of sulphur, bitartrate of potash, and confection of senna. An effervescing aperient may be prepared by mixing three drachms of the bitartrate with two and a half drachms of carbonate of soda: the resulting salt is the potash-tartrate of soda. As a *tooth-powder*, bitartrate of potash is sometimes used on account of its gritty qualities: a very good dentrifice consists of equal parts of bitartrate, powdered rhatany root, and myrrh.

ADMINISTRATION.—As a hydragogue cathartic the dose is from four to eight drachms: as an aperient, one or two drachms: as a diuretic, in repeated doses of a scruple to a drachm. *Imperial* (*tisana imperialis*) is formed by adding boiling water to cream of tartar, and flavouring with lemon-peel and sugar. It may be taken, *ad libitum*, as a refrigerant drink in febrile complaints. *Cream of tartar whey* (*serum lactis tartarizatum*) is made by adding about two drachms of bitartrate to a pint of milk. It may be diluted with warm water, and taken in dropsical complaints. The *compound powder of jalap* (*pulvis jalapæ compositus*) of the London Pharmacopœia is composed of three ounces of jalap, six ounces of the bitartrate, and two drachms of ginger: the dose is from a scruple to a drachm in dropsical complaints.

Potas'sæ Tar'tras.—Tar'trate of Pot'ash.

HISTORY.—This salt was known to Lemery. It has been termed *tartarized tartar*, *tartarized kali*, *soluble tartar*, or *vegetable salt*.

PREPARATION.—It is readily prepared by saturating the bitartrate with the carbonate of potash. The proportions employed in the London Pharmacopœia are sixteen ounces (or as much as may be sufficient) of carbonate of potash dissolved in six pints of boiling water, and three pounds of powdered bitartrate of potash. After boiling, strain, and evaporate until a pellicle forms; then set aside to crystallize.

In this process the excess of acid in the bitartrate is saturated by the potash of the carbonate: the carbonic acid escapes.

PROPERTIES.—It is usually met with in the shops in a granular state, but it ought to be crystallized. The primary form of the crystals is a right oblique-angled prism. To the taste this salt is saline, and somewhat bitter. It deliquesces when exposed to the air, and is soluble in its own weight of water at 50°; the solution decomposes by keeping.

CHARACTERISTICS.—When heated to redness, it is decomposed, leaving as a residue charcoal and carbonate of potash. A solution of the tartrate produces a white precipitate with solutions of acetate of lead, nitrate of silver, and chloride of calcium; the precipitates being soluble in nitric acid. When heated, the salt evolves the odour of caromel. If an excess of any strong acid (as the sulphuric) be added to a solution of this salt, we obtain crystals of the bitartrate. Hence acids, and most acidulous salts, are incompatible with it: as also are tamarinds. The tartrate is readily distinguished from the bitartrate by its deliquescent property, its greater solubility, and its want of acidity.

Composition.—The following is the composition of this salt:—

	Eq.	Eq.Wt.	Per Cent.	Berzelius.
Potash	1	48	42·1	41·31
Tartaric Acid.	1	66	57·9	58·69
Tartrate of Potash	1	114	100·0	100·00

Impurity.—It may contain excess of acid or base, either of which is easily recognised; the one by litmus, the other by turmeric. The sulphates may be detected by chloride of barium throwing down a white precipitate insoluble in nitric acid.

Physiological Effects.—This salt is a gentle purgative, analogous in its action to the sulphate of potash, from which it differs in being milder in its operation, and partially digestible; for, like the other vegetable salts of the alkalies, it is decomposed in the system, and converted into the carbonate, in which state it is found in the urine.

It is said to have the power of preventing the griping of other more active cathartics; as senna and scammony; but, from my own personal observations, I doubt the correctness of this statement.

Uses.—It is employed as a mild purgative in dyspepsia, at the commencement of diarrhœa, in some liver complaints, &c. Sometimes it is used as an adjunct to other more active purgatives: as the infusion of senna.

Administration.—It may be given in doses of from two to three drachms to half an ounce, or even an ounce.

Order 11.—Compounds of Sodium.

So′dii Chlo′ridum.—Chlo′ride of So′dium.

History.—As this salt is a necessary and indispensable seasoning to our food, it doubtless must have been known to, and employed by, the first individuals of our race. The earliest notice of it occurs in the writings of Moses, (*Gen.* xix. 26; *Lev.* ii. 13) and Homer (*Iliad*, lib. ix. 214). It has received various names, such as *common salt*, *culinary salt*, and *muriate* or *hydrochlorate of soda*.

Natural History.—It occurs in both kingdoms of nature.

(*a.*) *In the inorganized kingdom.*—An enormous quantity of this salt is contained in the waters of the ocean. At an average calculation sea water contains 2·5 per cent. of chloride of sodium (*vide* various analyses of this fluid in Thomson's *System of Chemistry*, 6th ed. vol. iii. p. 196). It is found also in great abundance in mineral waters (Gairdner, *On Mineral Springs*, p. 12). It has not hitherto been found in the oldest stratified rocks (De la Beche, *Researches in Theoret. Geol.* p. 31), but is met with in all the later formations. Thus Mr. Featherstonhaugh (*Phil. Mag.* N. S. vol. v. p. 139; vol. vi. p. 75; and vol. vii. p. 198) states that salt or brine springs occur in certain parts of the United States, in the *old transition slate rocks*. Salt springs occur in various parts of England, in the *coal measures* (Bakewell, *Introd. to Geology*, 4th ed. p. 252). The rock salt of Cheshire, and the brine springs of Worcestershire, occur in