genizing remedy. It has only been used in diabetes, by Dr Rollo and others, under the name of Hepatized ammonia, in doses of five or ten drops twice or thrice a-day.

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

Take of
Fresh burnt lime,
Muriate of ammonia in powder, each four ounces;
Sublimed sulphur,
Warm water, each two ounces, by weight.

Sprinkle the water upon the lime, placed in an earthen vessel, and cover it up until the lime falls to powder, which, as soon as it is cold, is to be mixed by trituration with the sulphur and muriate of ammonia. Put the mixture into a retort, and distil with a sudden and sufficiently strong degree of heat. Keep the liquor thus obtained in a phial, accurately closed with a glass stopper.

The second process of the Dublin college is totally different. The ammonia and sulphuretted hydrogen are presented to each other in a nascent state, and with the undecomposed part of the water pass over into the receiver, while, in the retort, the lime remains combined with sulphuric and muriatic acid.

The hydro-sulphuret of ammonia was formerly called the *fuming liquor of Boyle*. It is of a dark red colour, and is extremely fetid. It differs from the hydro-sulphuret of ammonia, prepared by the preceding process, in containing a portion of uncombined alkali, to which, according to Berthollet, its property of emitting fumes is owing, and in the last portions which come over being in the state of a hydroguretted sulphuret. It soon, however, is converted into a hydro sulphuret, by losing its excess of ammonia and sulphur. It is decomposed by all acids, and almost all metallic solutions.

CHAP. II.—ACIDS.

ACIDUM SULPHURICUM DILUTUM. *Ed.*
Diluted Sulphuric Acid.

Take of
Sulphuric acid, one part;

Water, seven parts.
Mix them.

Dub.

Take of
Sulphuric acid, two ounces, by weight;
Distilled water, fourteen ounces, by weight.
Having gradually mixed them, set the mixture aside to cool, and then pour off the clear liquor.
The specific gravity of this acid is 1090.

Lond.

Take of
Sulphuric acid, one fluidounce and a half;
Distilled water, fourteen fluidounces and a half.
Add the acid by degrees to the water, and mix.

THE most simple form in which sulphuric acid can be advantageously employed internally, is that in which it is merely diluted with water: and it is highly proper that there should be some fixed standard, in which the acid in this state should be kept. It is, however, much to be regretted, that the same standard with respect to strength has not been uniformly adopted; and especially that the London college should have deviated so very remarkably, both from their own former editions and from the other colleges. In the Edinburgh and Dublin Pharmacopœias, the strong acid is one-eighth by weight of the mixture, which gives one drachm in the ounce, which has at least the merit of convenience. Dr Powell, whose translation may be considered as official, states, in defence of the change, that the new mixture will be more conveniently made, and that its proportionate dose is easily administered, especially as minute attention thereto is not of any great practical importance. An ounce of sulphuric acid, by measure, is equal to 14 dr. and eight-tenths of a grain. Dr Powell says, that the diluted acid of this edition is stronger as about 5 to 4, but in another place as 3 to 2, and that it contains $\frac{1}{10}$ of acid. The comparative strengths of equal bulks and of equal weights of the diluted acids in the different Pharmacopœias, are nearly in the following proportions:

	Bulks.	Weights.	Sp. gr.
Former London,	1000	1000	1.070
Dublin, -		1118	1.090
Edinburgh, -		1125	
New London,	1480	1445	1.111 Ph.

Dr Powell says, that one ounce of the last will saturate about 107 grains of dried sub-carbonate of soda, which is confirmed by Mr Phillips. The dilution by means of distilled water is preferable to spring water; which, even in its purest state, is not free from impregnations affecting the acid. Even when distilled water is used, there is often a small quantity of a white precipitate, arising from lead dissolved in the acid.

Sulphuric acid has a very strong attraction for water: and their bulk, when combined, is less than that of the water and acid separately. At the same time, there is a very considerable increase of temperature produced, which is apt to crack glass vessels, unless the combination be very cautiously made; and, for the same reason, the acid must be poured into the water, not the water into the acid. Sulphuric acid, according to Powell, diluted with an equal measure of water, and allowed to cool, rose 21° on the addition of another measure, and 7° after cooling again on the addition of a third.

Table of the Quantity of Real Acid in 100 *parts of Liquid Sulphuric Acid, at the temperature* 60°. *Dalton.*

Atoms.		*Acid per cent. by weight.*	*Acid per cent. by measure.*	*Specific gravity.*	*Boiling point.*
Acid.	*Water.*				
1 +	0	100	unknown.	unknown.	
1 +	1	81	150	1.850	620°
		80	148	1.849	605
		79	146	1.848	590
		78	144	1.847	575
		77	142	1.845	560
		76	140	1.842	545
		75	138	1.838	530
		74	135	1.833	515
		73	133	1.827	501
		72	131	1.819	487
		71	129	1.810	473
		70	126	1.801	460
		69	124	1.791	447
1 +	2	68	121	1.780	435
		67	118	1.769	422
		66	116	1.757	410
		65	113	1.744	400
		64	111	1.730	391
		63	108	1.715	382
		62	105	1.699	374
		61	103	1.684	367
		60	100	1.670	360
1 +	3	58.6	97	1.650	350
		50	76	1.520	290
		40	56	1.408	260
1 +	10	30	39	1.30+	240
1 +	17	20	24	1.200	224
1 +	38	10	11	1.10—	218

Med. use.—Diluted sulphuric acid is an excellent tonic, checking fermentation, exciting appetite, promoting digestion, and quenching thirst, and it is therefore used with success in morbid acidity, weakness, and relaxation of the stomach. As an astringent, it is used in hæmorrhagies; and from its refrigerant and antiseptic properties, it is a valuable medicine, in many febrile diseases, especially those called putrid. If taken in any considerable quantity, or for some time, it seems to pass off undecomposed by the kidneys or skin; and it is perhaps by its stimulant action on the latter, that it is advantageously employed internally, in psora, and other cutaneous affections. The best mode of prescribing it, is to order the quantity of acid to be used, and to direct it to be mixed with as much water as will render it palatable, to which some syrup or mucilage may be added. To prevent it from attacking the teeth, it may be conveniently sucked through a quill, and the mouth should be carefully washed after each dose.

Externally it is used as a gargle, particularly in putrid sore throats, and in aphthous mouths, and as a wash in cutaneous eruptions, and ill-conditioned ulcers. Made into an ointment with sixteen times its weight of axunge, it has been used to cure psora.

Acidum nitrosum. *Ed.*
Nitrous Acid.

Take of
Nitrate of potass, bruised, two pounds;
Sulphuric acid, sixteen ounces.
Having put the nitrate of potass into a glass retort, pour upon it the sulphuric acid, and distil in a sand-bath with a heat gradually increased, until the iron-pot begins to be red hot.
The specific gravity of this acid is to that of distilled water as 1550 to 1000.

Dub.

Take of
Nitrate of kali, six pounds;
Sulphuric acid, four pounds.
Mix and distil, until the residuum becomes dry.
The specific gravity of this acid is 1500.

Acidum nitricum. *Ed.*
Nitric Acid.

Take of
Nitrous acid, any quantity.

Pour it into a retort, and having adapted a receiver, apply a very gentle heat, until the reddest portion shall have passed over, and the acid which remains in the retort shall have become nitric acid.

Lond.

Take of
Nitrate of potass dried,
Sulphuric acid, each two pounds by weight.
Mix in a glass retort, and by means of a sand-bath distil off the nitric acid until red fumes appear. Then re-distil the acid in the same manner, having previously added another ounce of dried nitrate of potass.
The specific gravity of nitric acid is 1.5. If a piece of limestone be put into a fluidounce of it, diluted with water, one ounce should be dissolved.

In this process, the sulphuric acid, by its superior affinity, combines with the potass of the nitre, to form sulphate of potass, while the nitric acid is separated, and is converted into vapour, by the application of the heat to the retort, and is condensed in the receiver.

In performing this process, we must take care, in pouring in the sulphuric acid, not to soil the neck of the retort. Instead of a common receiver, it is of advantage to use some modification of Woulfe's apparatus; and as the vapours are extremely corrosive, the fat lute must be used to connect the retort with it. The London college, intending that the product should be *nitric* acid, direct us to continue the process only until red fumes appear; but there are red fumes from the very first. Mr Stocker says, that by careful distillation, the London process affords nine ounces of straw-coloured nitric acid, sp. gr. 1.5404; after which the fumes become deeper red, and the product darker, inclining to orange; but the total product is but slightly coloured, amounts to ten or eleven ounces, and has the sp. gr. required. The London college formerly used no more sulphuric acid than what was necessary to expel all the nitric acid, and the residuum was a neutral sulphate of potass, so insoluble, that it could not be got out without breaking the retort. The Edinburgh and Dublin colleges order as much sulphuric acid as renders the residuum an acidulous sulphate of potass, easily soluble in water, and the London college now employ a still larger quantity. We are informed by Dr Powell, that the reason for the adoption of these proportions for nitric acid is expressed in the following report to the college.

Dried nitre.	Sulph. acid.	Colour of product.	Sp. Gr.	Weight of product.	Marble dissolv.	Relative value.
6	6	White.	1.50	4	0.73	29
6	3	Red.	1.53	3	0.70	21
60	29	Red.	1.456	30+	0.62	19+

When the proportions were, 6 nitric and 3 sulphuric acid, there remained no redundant acid." This report cannot be correct. It was incredible, that there should be so great a difference between the second and third of the results stated in the report, when the difference in the materials used is so trifling; that the specific gravity of the first product, consisting of nitric acid, should be less than that of the second, red nitrous acid; and that of these two, the one whose specific gravity is least should dissolve most marble Accordingly Mr Phillips obtained, by the first and third processes, acids of a pale greenish-yellow colour, and the specific gravity in the last instance was 1.51 instead of 1.456. Nitric acid, from Apothecaries Hall, is greenish-yellow, and weighs specific gravity 1.424. The former impression of this edition of the London Pharmacopœia stated, that a fluidounce of this diluted acid dissolved 420 grains of marble. The quantity is increased in the present to 480. Mr Phillips found a fluidounce sp. gr. 1.5 to dissolve 476 grains. It is also to be regretted, that, in the report, there is no statement of the results of the process of the Edinburgh and Dublin colleges, for although the old London proportion of one half acid was manifestly too little, equal parts may be too much, and the intermediate proportions of 6 to 4 may be preferable to either. The manufacturers of nitrous acid use *rough nitre* with one half its weight of sulphuric acid.

Nitrous acid is frequently impure. The presence of sulphuric acid is detected by nitrate of barytes; but before applying this test, the acid must be diluted, as otherwise the salt itself is precipitated in consequence of the acid attracting the water in which it is dissolved. Sulphuric acid is easily got rid of by re-distilling the nitrous acid from a small quantity of nitrate of potass, and this rectification forms part of the new London process; as, from the large proportion of sulphuric acid used by them, they seem to have anticipated this contamination, which however does not take place, not even, according to Mr Stocker, when the distillation is continued, until the saline mass is brought into a state of fusion.

Muriatic acid is detected by the precipitate formed with nitrate of silver, and may be separated by dropping into the ni-

trous acid a solution of nitrate of silver, as long as it forms any precipitate, and drawing off the nitrous acid by distillation.

Sir H. Davy has shewn, that nitrous acid is a compound of nitric acid and nitric oxide; and that, by additional doses of the last constituent, its colour is successively changed from yellow to orange, olive green, and blue green, and its specific gravity is diminished. As commonly prepared, the acid is more or less high coloured, and emits red fumes; whereas pure nitric acid emits only white fumes. Hence the Edinburgh college have given a process for converting nitrous into nitric acid, which Dr Powell thinks uneconomical, as not only nitrous gas, but a large proportion of the acid itself, passes to waste.

By the application of a gentle heat, the whole of the nitric oxide is vaporized, and pure colourless nitric acid remains in the retort. The nitric oxide, however, carries over with it a portion of the acid, and condenses with it in the receiver, in the form of a very high-coloured nitrous acid.

Richter has given the following process for preparing nitric acid.

Take of
Purified nitrate of potass, seven pounds;
Black oxide of manganese, one pound, two ounces;
Sulphuric acid, four pounds, four ounces, and six drachms.
Into a retort capable of containing twenty four-pounds, introduce the nitre and manganese, powdered and mixed, and pour upon them gradually, through a retort funnel, the sulphuric acid. Lute on the receiver with flour and water, and conduct the distillation with a gradually increased heat.

From these proportions, Richter got three pounds nine ounces of very slightly coloured nitric acid. The operation will be conducted with less hazard in a Woulfe's apparatus, or by interposing between the retort and receiver a tubulated adopter, furnished with a bent tube, of which the further extremity is immersed in a vessel containing a small quantity of water.

The specific gravity of nitrous acid is probably stated too high by the Edinburgh college; for, although Rouelle makes that of the strongest nitric acid 1.583, yet Kirwan could produce it no stronger at 60 than 1.5543. Sir H. Davy makes it only 1.504, and when saturated with nitric oxide, only 1.475; and Mr Phillips says it varies from 1.509 to 1.519.

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

Take of
Nitrous acid,
Water, equal weights.
Mix them, taking care to avoid the noxious vapours.

Dub.

Take of
Nitrous acid,
Distilled water, each one pound.
Mix.
The specific gravity is 1280.

ACIDUM NITRICUM DILUTUM. *Lond.*
Diluted Nitric Acid.

Take of
Nitric acid, one fluidounce;
Distilled water, nine fluidounces.
Mix.

NITROUS ACID has a great affinity for water, and attracts it from the atmosphere. During their combination there is an increase of temperature, part of the nitric oxide is dissipated in the form of noxious vapours, and the colour changes successively from orange to green, and to blue, according as the proportion of water is increased. A mixture of equal parts of Kirwan's standard acid of 1.5543 and water, has the specific gravity 1.1911. The diluted acid of the London pharmacopœia is about 1.08.

In fact, one ounce of nitric acid, by measure, is equal to one ounce, three drachms, 21.75 grains, by weight; and one liquidounce saturates about 48 grains of white marble. The strength of the diluted nitric acid of the former London Pharmacopœia is to that of the present as 4 to 1.

Table of the Quantity of Real Acid in 100 *parts of Liquid Nitric Acid at* 60°. *Dalton.*

Atoms.		*Acid per cent. by weight.*	*Acid per cent. by measure.*	*Specific gravity.*	*Boiling pint.*
Acid.	*Water.*				
1 +	0	100	175?	1.75?	30°?
2 +	1	82.7	134	1.62	100?
1 +	1	72.5	112	1.54	175
		68	102	1.50	210
		58.4	84.7	1.45	240
1 +	2	54.4	77.2	1.42	248
		51.2	71.7	1.40	247
1 +	3	44.3	59.8	1.35	242
1 +	4	37.4	48.6	1.30	236
1 +	5	32.3	40.7	1.26	232
1 +	6	28.5	34.8	1.22	229
1 +	7	25.4	30.5	1.20	226
1 +	8	23	27.1	1.18	223
1 +	9	21	24.6	1.17	221
1 +	10	19.3	22.4	1.16	220
1 +	11	17.8	20.5	1.15	219
1 +	12	16.6	18.9	1.14	219

These acids, the nitrous and nitric, have been long employed as powerful pharmaceutic agents. Their application in this way I shall have many opportunities of illustrating.

Medical use.—Lately, however, their use in medicine has been considerably extended. In the state of vapour they have been used to destroy contagion in gaols, hospitals, ships, and other places where the accumulation of animal effluvia is not easily avoided. The fumigating such places with the vapour of nitrous acid has certainly been attended with success; but we have heard that success ascribed entirely to the ventilation employed at the same time. Ventilation may unquestionably be carried so far, that the contagious miasmata may be diluted to such a degree that they shall not act on the body; but to us it appears no less certain, that these miasmata cannot come in contact with nitric acid or oxymuriatic acid vapour, without being entirely decomposed and completely destroyed. Fumigation is, besides, applicable in situations which do not admit of sufficient ventilation; and where it is, the previous diffusion of acid vapours is an excellent check upon the indolence and inattention of servants and nurses, as by the smell we are enabled to judge whether they have been sufficiently attentive to the succeeding ventilation. Nitric acid vapour, also, is not deleterious to life, and may be diffused in the apartments of the sick, without occasioning to them any material inconvenience. The means of diffusing it are easy. Half

an ounce of powdered nitre is put into a saucer, which is placed in a pipkin of heated sand. On the nitre two drachms of sulphuric acid are then poured. The fumes of nitric acid immediately begin to rise. This quantity will fill with vapour a cube of ten feet; and by employing a sufficient number of pipkins, the fumes may be easily made to fill a ward of any extent. For introducing this practice, Dr Carmichael Smyth received from the British Parliament a reward of five thousand pounds.

The internal use of these acids has also been lately much extended. In febrile diseases, water acidulated with them forms one of the best antiphlogistic and antiseptic drinks we are acquainted with. Hoffman and Eberhard long ago employed it with very great success in malignant and petechial fevers; and in the low typhus, which frequently rages among the poor in the suburbs of Edinburgh, I have repeatedly given it with unequivocable advantage. In the liver complaint of the East Indies, and in syphilis, nitric acid has also been extolled as a valuable remedy by Dr Scott, and the evident benefits resulting from its use in these complaints has given rise to a theory, that mercury only acts by oxygenizing the system. It is certain that both the primary and secondary symptoms of syphilis have been removed by the use of these acids, and that the former symptoms have not returned, or been followed by any secondary symptoms. But in many instances they have failed; and it is doubtful if ever they effected a permanent cure, after the secondary symptoms appeared. Upon the whole, the opinions of Mr Pearson on this subject, lately agitated with so much keenness, appear to us so candid and judicious, that we shall insert them here. He does not think it eligible to rely on the nitrous acid in the treatment of any one form of the lues venerea: at the same time, he by no means wishes to see it exploded as a medicine altogether useless in that disease. When an impaired state of the constitution renders the introduction of mercury into the system inconvenient, or evidently improper, the nitrous acid will be found, he thinks, capable of restraining the progress of the disease, while, at the same time, it will improve the health and strength of the patient. On some occasions, this acid may be given in conjunction with a mercurial course, and it will be found to support the tone of the stomach, to determine powerfully to the kidneys, and to counteract, in no inconsiderable degree, the effects of mercury on the mouth and fauces.

ACIDUM MURIATICUM. *Ed.*
Muriatic Acid.

Take of
Muriate of soda, two pounds;
Sulphuric acid, sixteen ounces;
Water, one pound.
Heat the muriate of soda for some time red-hot in a pot, and after it has cooled, put it into a retort. Then pour upon the muriate of soda the acid mixed with the water and allowed to cool. Lastly, distil in a sand-bath, with a moderate fire, as long as any acid comes over.
The specific gravity of this acid is to that of distilled water as 1170 to 1000.

Lond.

Take of
Dried muriate of soda, two pounds;
Sulphuric acid, by weight, twenty ounces;
Distilled water, a pint and a half.
First mix the acid with half a pint of the water in a glass retort, and add to the mixture, after it has cooled, the muriate of soda. Pour the rest of the water into the receiver; then having fitted on the retort, distil the muriatic acid over into this water, with the heat of a sand-bath gradually increased until the retort become red.
The specific gravity of this acid is to that of distilled water as 1160 to 1000.
If a piece of limestone be put into a fluidounce of this acid diluted with water, 220 grains should be dissolved.

Dub.

Take of
Muriate of soda, dried,
Sulphuric acid,
Water, each six pounds.
Add the acid, diluted with the water, after the mixture has cooled, gradually to the salt, in a glass retort, and then distil the liquor, until the residuum becomes dry.
The specific gravity of this acid is 1170.

IN this process the muriate of soda is decomposed, and the muriatic acid disengaged by the superior affinity of the sulphuric acid. But as muriatic acid is a permanently elastic fluid, the addition of the water is absolutely necessary for its

existence in a fluid form. The London college put a portion of water into the receiver, for the purpose of absorbing the muriatic acid gas, which is first disengaged, and which would otherwise be lost for want of water to condense it: the other colleges, however, order the whole of the water to be previously mixed with the sulphuric acid; and it is indispensably necessary that the mixture of acid and water be allowed to cool before it be added to the salt; for the heat produced is so great, that it would not only endanger the breaking of the retort, but occasion considerable loss and inconvenience, by the sudden disengagement of muriatic acid gas. Dr Powell thinks it is an improvement to add the salt to the diluted acid, but it is less convenient.

Mr Phillips has given us a tabular view of the results of the processes of the London pharmacopœias, 1809 and 1787, and of a modification of the latter.

	Mur. soda.	Sulph. acid.	Water.	Cost.	Product.	Sp. gr.	Marble decomp.
1787	35	21	17.5	56	29.75	1.188	15.09
Modif.	35	21	22.	56	35.	1.174	16.43
1809	32	24	39.4	56	43.68	1.142	17.16

It may be observed, that according to these experiments, the new process does not produce an acid nearly of the strength ordered by the college, its specific gravity being 1.142 instead of 1.160, and the fluidounce decomposing only 204 instead of 220 grains of marble, while muriatic acid from Apothecaries Hall is of specific gravity 1.158. The difference of strength from the statement in the edition 1809 was greater, as the sp. gr. was said to be 1.170, and the solvent power 240; it may now be accounted for by some variation in the manipulation, especially as Dr Powell quotes the present statement as the result of experiment. At any rate, the new process is more economical, as at a given expence it produces a greater solvent power.

The muriate of soda, which should be of the kind called Bay Salt, is directed by Dublin and Edinburgh to be heated to redness, before it be introduced into the retort, that the whole of the water of crystallization may be expelled, which being variable in quantity, would otherwise affect the strength of the acid produced; and besides, without this precaution, the acid obtained is too high coloured. The London college use the salt dried, but not decrepitated.

The charge should not occupy more than half the body of

the retort; and if a common retort and receiver be employed for this distillation, they must not be luted perfectly closely; for if any portion of the gas should not be absorbed by the water employed, it must be allowed to escape; but the process will be performed with greater economy, and perfect safety, in a Woulfe's, or some similar apparatus. The muriatic acid gas, on its condensation, gives out, according to Dr Powell, a considerable heat, so that it is necessary to keep the receiver cooled during the process.

The residuum in the retort consists principally of sulphate of soda, which may be purified by solution and crystallization; and to save the retort, Dr Powell directs it to be filled with boiling water, after the process is over, and it has cooled down to 212°.

If properly prepared, the muriatic acid is perfectly colourless, and possesses the other properties already enumerated; but in the shops it is very seldom found pure. It almost always contains iron, and very frequently sulphuric acid or copper. The copper is detected by the blue colour produced by super-saturating the acid with ammonia, the iron by the black or blue precipitate formed with tincture of galls or prussiate of potass. The sulphuric acid may be easily got rid of by redistilling the acid from a small quantity of dried muriate of soda. But Mr Hume discovered, that muriate of baryta is precipitated when poured into pure muriatic acid, from the acid attracting the water of the salt.

Medical use.—In its effects on the animal economy, and the mode of its employment, it coincides with the acids already mentioned, which almost proves, that they do not act by oxygenizing the system. On the contrary, according to Sir H. Davy's view of its constitution, it contains no oxygen, and can only act *chemically* by imparting chlorine or hydrogen to the system, or withdrawing from it oxygen or some other principle which has an affinity for chlorine or hydrogen.

Acidum muriaticum dilutum. *Dub.*
Diluted Muriatic Acid.

Take of
Muriatic acid,
Distilled water, each one pound. Mix.
The specific gravity is 1080.

This diluted acid of a fixed strength, is convenient for apportioning its dose; and as it is now introduced by the Dublin college, it is to be hoped that the same proportions will be adhered to by the others.

Table of the quantity of real Acid in 100 parts of Liquid Muriatic Acid, at the Temperature of 60°. Dalton.

Atoms. Acid.	Atoms. Water.	Acid per cent. by weight.	Acid per cent. by measure.	Specific Gravity.	Boiling Point. 60°
1	1	73.3			
1	2	57.9			
1	3	47.8	71.7?	1.500?	
1	4	40.7			
1	5	35.5			
1	6	31.4			
1	7	28.2			
1	8	25.6	30.5	1.199	120
1	9	23.4	27.5	1.181	145
1	10	21.6	25.2	1.166	170
1	11	20.0	23.1	1.154	190
1	12	18.7	21.4	1.144	212
1	13	17.5	19.9	1.136	217
1	14	16.4	18.5	1.127	222
1	15	15.5	17.4	1.121	228
1	20	12.1	13.2	1.094	232
1	25	9.91	10.65	1.075	228
1	30	8.40	8.93	1.064	225
1	40	6.49	6.78	1.047	222
1	50	5.21	5.39	1.035	219
1	100	2.65	2.70	1.018	216
1	200	1.36	1.37	1.009	214

Table of the quantity of Muriatic Acid Gas in solutions of different Specific Gravities. Sir H. Davy.

At temperature 45° Fahrenheit. Barometer 30.		At temperature 45° Fahrenheit. Barometer 30.	
100 parts of solution of muriatic acid gas in water, of spec. gravity	Contain of muriatic acid gas, parts	100 parts of solution of muriatic acid gas in water, of spec. gravity	Contain of muriatic acid gas, parts
1.21	42.43	1.10	20.20
1.20 *	40.80	1.09	18.18
1.19	38.38	1.08	16.16
1.18	36.36	1.07	14.14
1.17	34.34	1.06	12.12
1.16 *	32.32	1.05	10.10
1.15	30.30	1.04	8.08
1.14	28.28	1.03	6.06
1.13	26.26	1.02	4.04
1.12	24.24	1.01	2.02
1.11 *	22.3		

AQUA ALCALINA OXYMURIATICA. *Dub.*
Oxymuriatic Alkaline Water.

Take of
Dried muriate of soda, two pounds;
Manganese, in powder, one pound;
Water,
Sulphuric acid, each two pounds.

Mix the muriate of soda and manganese; put them into a matrass, and pour on the water. Then, by means of a proper apparatus, add the sulphuric acid gradually, and at different times, and pass the gas thus extricated through a solution of four ounces of carbonate of kali, in twenty-nine ounces, by measure, of water. Towards the end of the operation, heat the matrass moderately.

The specific gravity is 1087.

THIS is commonly considered as a solution of the oxygenated muriate of potass; the oxymuriatic acid is disengaged in the matrass, by the action of the sulphuric acid on the muriate of soda, and black oxide of manganese, which latter furnishes the additional dose of oxygen to the muriatic acid disengaged from the former; and the oxymuriatic acid gas thus formed, readily combines with the potass of the solution of the alkaline salt, through which it is made to pass while the carbonic acid is expelled.

But, according to Sir Humphry Davy, this is a combination of chlorine with potass: the hydrogen of the muriatic acid in the muriate of soda combining with the oxygen of the black oxide of manganese, the chlorine is set at liberty, and combines with the potass dissolved in the water through which it is made to pass.

Oxymuriate of potass in solution was some years ago strongly recommended as an antisyphilitic remedy, and its use was extended to other cutaneous diseases, and finally to fever and spasmodic diseases, as a general stimulant. It was given in the dose of from three to ten grains, four times a-day, gradually increasing to 25 or 30. At the time, many singular cures performed by means of it were recorded, but it has fallen into disuse, and we do not now hear of its employment; although its introduction so lately into the Dublin Pharmacopœia would lead us to presume that it is still used in Ireland. It sometimes acted as a diuretic, always as a stimulant; and it is singular, that in some cases, in which it produced little or no effect, it passed off undecomposed in the urine.

In these cases Mr Cruickshank proposed to remedy the defect, by giving, after each dose, 10 or 15 drops of muriatic acid.

Aqua oxymuriatica. *Dub.*
Oxymuriatic Water,

Is prepared by transmitting, in a proper apparatus, the superfluous gas of the preceding process through a pint of water.

The specific gravity is 1003.

The oxygenated muriatic acid was also, when the chemical pathology was fashionable, recommended as an antisyphilitic remedy, and it certainly seemed, in some instances, to effect cures; but it has since been laid aside. Mr Braithwaite also recommended it strongly in scarlatina. He gave, according to the age of the patient, from half a drachm to a drachm, in the course of the day, mixed with eight ounces of distilled water; but it is advisable to divide it into doses, in different phials, as it loses every time the phial is opened, and it should be kept in a dark place. Dr Willan confirms its use in cynanche maligna.

The vapours of this powerfully decomposing acid have been recommended by Morveau as the best means of destroying contagion. As, however, they are deleterious to animal life, they cannot be employed in every situation. Where applicable, they are easily disengaged by mixing together ten parts of muriate of soda, and two parts of black oxide of manganese in powder, and pouring upon the mixture, first four parts of water, and then six parts of sulphuric acid. Fumes of oxygenized muriatic acid are immediately disengaged.

Morveau has since contrived what he calls Dis-infecting or Preservative phials. If intended to be portable, 46 grains of black oxide of manganese, in coarse powder, are to be put into a strong glass phial, of about $2\frac{1}{3}$ cubic inches capacity, with an accurately ground stopper, to which must be added about $\frac{45}{100}$ of a cubic inch of nitric acid of 1.4 specific gravity, and an equal bulk of muriatic acid of 1.134; the stopper is then to be replaced, and the whole secured by inclosing the phial in a strong wooden case, with a cap which screws down so as to keep the stopper in its place. They are used by simply opening the phial without approaching it to the nose, and shutting it as soon as the smell of the muriatic gas is perceived. A phial of this kind, if properly prepared, will preserve its power during many years. For small wards, strong bottles,

with ground stoppers an inch in diameter, of about 25 or 27 cubic inches of capacity, may be used, with 372 grains of the oxide, and 3.5 inches of each of the acids, and the stopper kept in its place by leaden weights; or for larger wards, very strong glass jars, about 43 cubic inches in capacity, containing an ounce of the oxide, and 6 inches of each of the acids. These jars are to be covered with a plate of glass, adjusted to them by grinding with emery, and kept in its place by a screw. In no case is the mixture to occupy more than one-third of the vessel.

ACIDUM ACETOSUM DESTILLATUM. *Ed.*
Distilled Acetous Acid.

Let eight pounds of acetous acid be distilled in glass vessels, with a gentle heat. The two first pounds which come over, being too watery, are to be set aside; the next four pounds will be the Distilled acetous acid. The remainder furnishes a still stronger, but empyreumatic acid.

ACETUM DISTILLATUM. *Dub.*
Distilled Vinegar.

Take of
Vinegar, ten pints.
Draw off, with a gentle heat, six pints.
Glass vessels are to be employed in this distillation, and the first pint which comes over is to be rejected.
The specific gravity of this acid is 1006.

ACIDUM ACETICUM. *Lond.*
Acetic Acid.

Take of
Vinegar, a gallon.
Distil off the acetic acid in a sand bath, from a glass retort, into a cooled glass receiver; then, having thrown away the first pint, preserve the next six.

VINEGAR, when prepared from vinous liquors by fermentation, besides acetous acid and water, contains mucilage, extractive, super-tartrate of potass, and often citric or malic acid, alcohol, and a peculiar agreeable aroma. These substances, particularly the extractive and super-tartrate of potass, render it apt to spoil, and unfit for pharmaceutic and chemical purposes. By distillation, however, the acetic acid is easily separated from such of these substances as are not volatile, although it still contains some little extractive matter, as is proved by its assuming a brown colour, when satu-

rated with potass. But by distillation it loses its agreeable flavour, and becomes considerably weaker; for the spirit and water, being rather more volatile than acetic acid, come over first, while the last and strongest portion of the acid cannot be obtained free from empyreuma.

This process may be performed in a common still, but a retort, which should be very large, as the liquor is apt to boil over, is preferable. The best kinds of wine vinegar should be used; and, even with these, if the distillation be carried on to any great length, it is extremely difficult to avoid empyreuma. The best method, however, is, if a retort be used, to place the sand but a little way up its sides, and, when somewhat more than half the liquor has come over, to pour upon the remainder a quantity of fresh vinegar equal to the liquor drawn off. This may be repeated three or four times; the vinegar supplied at each time being previously heated, as the addition of cold liquor would not only prolong the operation, but also endanger the breaking of the retort. Lowitz recommends the addition of half an ounce of recently burnt and powdered charcoal to each pound of vinegar in the still, as the best means of avoiding empyreuma.

If the common still be employed, it should likewise be occasionally supplied with fresh vinegar, in proportion as the acid runs off, and this continued until the process cannot be conveniently carried farther. The distilled acid must be rectified by a second distillation, in a retort or glass alembic; for, although the head and receiver be of glass or stoneware, the acid will contract a metallic taint from the pewter worm.

The residuum of this process is commonly thrown away as useless. If mixed with about three times its weight of fine dry sand, and committed to distillation in a retort, with a well-regulated fire, it yields an exceedingly strong empyreumatic acid. Besides, it is, without any rectification, better for some purposes, as being stronger than the pure acid; particularly for making acetate of potass or soda; for, in the process for preparing these, the empyreumatic oil is burnt out.

Mr Phillips says, that the best malt vinegar has a specific gravity 1.0204; that the first eighth part which it yields on distillation, is of sp. gr. 0.99712, has a decidedly acid taste, and a fluidounce decomposes from 4.5 to 5 grains of precipitated carbonate of lime; while the subsequent six-eighths are of specific gravity 1.0023, and a fluidounce decomposes 8.12 grains of carbonate of lime. Hence he concludes, that it is improvident to reject the first eighth, since it contains about one-twelfth of the acid obtained, and there is no circumstance

rendering it necessary to have distilled vinegar either of very equal or very great strength.

Distilled vinegar should be colourless and transparent, specific gravity from 1.007 to 1.0095, have a pungent smell, and purely acid taste, totally free from acrimony and empyreuma, and should be entirely volatile. One fluidounce should dissolve at least 13 grains of white marble, according to Dr Powell. Distilled vinegar should not form a precipitate on the addition of a solution of baryta, or of water saturated with sulphuretted hydrogen; or change its colour when supersaturated with ammonia. These circumstances shew, that it is adulterated with sulphuric acid, or contains lead, copper, or tin.

Distilled acetous acid, in its effects on the animal economy, does not differ from vinegar; and as it is less pleasant to the taste, it is only used for pharmaceutical preparations.

Acidum aceticum. *Dub.*
Acetic Acid.

Take of
Acetate of kali, six ounces;
Sulphuric acid, three ounces, by weight.
Pour the acid into a tubulated retort, and gradually add the acetated kali in different portions, waiting, after every addition, until the mixture cools; then distil off the acid, with a moderate heat, until the residuum become dry.
The specific gravity of this acid is 1070.

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

Take of
Sulphate of iron dried, one pound;
Acetate of lead, ten ounces.
Having rubbed them together, put them into a retort, and distil in a sand-bath, with a moderate heat, as long as any acid comes over.

By these processes, the acid we have before noticed, under the title of acetic acid, is prepared. It is now generally believed to differ from distilled vinegar only in strength, and in being perfectly free from all mucilaginous matter; therefore, according to the principles of nomenclature, which gives simple names to simple substances, the strong acid should be acetic acid, and our present acetous acid should be weak or dilute acetic acid.

Many different processes have been proposed for preparing acetic acid, but they may be arranged in three classes. It may be prepared,

1. By decomposing metalline acetates by heat.
2. ——————— acetates by sulphuric acid.
3. ——————— acetates by sulphates.

The process in the former edition of the London college is an example of the first kind; but the heat necessary for decomposing verdigris is so great, that it decomposes part of the acetic acid itself, and gives the product an empyreumatic and unpleasant smell.

By the superior affinity of sulphuric acid, the acid may be easily expelled from every acetate, whether alkaline or metallic; but part of the sulphuric acid seems to be deprived of its oxygen, and to be converted into sulphurous acid, which renders the product impure.

The processes of the last kind are preferable to the others in many respects. They are both more economical, and they furnish a purer acid. Mr Lowitz directs one part of carefully dried acetate of soda to be triturated with three parts of supersulphate of potass, and the distillation to be conducted in a glass retort, with a gentle heat. The Berlin college mix together twelve ounces of sulphate of potass with six of sulphuric acid, diluted with eighteen of water, and evaporate to dryness. With the supersulphate of potass, thus prepared, they decompose nine ounces of acetate of soda, dried with a gentle heat *. The process of the Edinburgh college also belongs to this class, and was first proposed by C. Badollier, apothecary at Chartres.

Medical use.—It is almost solely used as an analeptic remedy in syncope, asphyxia, hysteric affections, and headachs. Applied to the skin, it acts as a stimulant and rubefacient, but it is most frequently snuffed up the nostrils in the state of vapour.

Acidum benzoicum. *Ed.*
Benzoic Acid.

Take of
Benzoin, twenty-four ounces;
Carbonate of soda, eight ounces;
Water, sixteen pounds.
Triturate the benzoin with the carbonate, then boil in the water for half an hour, with constant agitation, and strain.

* The acid residuum of the distillation of nitrous acid would be a very economical substitute.

Repeat the decoction, with other six pounds of water, and strain. Mix these decoctions, and evaporate, until two pounds remain. Filter anew, and drop into the fluid, as long as it produces any precipitation,

Diluted sulphuric acid.

Dissolve the precipitated benzoic acid in boiling water, strain the boiling solution through linen, and set it aside to crystallize. Wash the crystals with cold water, dry and preserve them.

Dub.

Take of

Benzoin, any quantity.

Liquefy it in a retort with a wide throat, having a receiver fitted to it, but not luted, and sublime. Remove the sublimed matter occasionally from the neck of the retort, lest it accumulate in too great a quantity. If it be soiled with oil, press it, folded up in blotting paper, and repeat the sublimation.

Lond.

Take of

Benzoin, one pound and a half;

Fresh lime, four ounces;

Water, a gallon and a half;

Muriatic acid, four fluidounces.

Triturate the benzoin with the lime, then boil for half an hour in a gallon of the water, stirring it assiduously with a spatula, and decant the liquor when cold. Boil the residuum again in four pints of water, and decant the liquor as before: then boil down the liquors mixed together to one half; filter through paper, and gradually drop in the muriatic acid, until there be no more precipitate.

Lastly, having poured off the liquor, dry the powder with a gentle heat, put it in a proper vessel, placed in a sand bath, and sublime the benzoic acid with a gentle heat.

The distinguishing character of balsams is their containing benzoic acid, which may be separated from the resin, their other principal constituent, either by simple solution in water, sublimation, or by combining it with a salifiable base. The Dublin college directs it to be done in the second way. But, even with the greatest care, it is almost impossible to manage the heat so as not to decompose part of the resin, and thus give rise to the formation of an empyreumatic oil, which

contaminates the product. Nor can it be freed completely from the empyreumatic oil by bibulous paper.

The other method of separating benzoic acid from resin, was first practised by Scheele, who employed lime water; Göttling afterwards used carbonate of potass; and, lastly, Gren used carbonate of soda, which has been adopted by the Berlin college, and now by that of Edinburgh. Mr Brande, and he has been followed by the London college, prefers Scheele's process, as the lime dissolves less of the resin of the benzoin than the alkalies do. In experiments which he made for the purpose of ascertaining the comparative value of the different processes, he obtained from one pound of benzoin,

	Grains.
By sublimation, - - - -	960
— Scheele's process, - - -	899
— Gren's and Göttling's process, - -	810
— boiling benzoin in water, - -	490

As the crystallized acid, on account of its lightness and elasticity, is not easily reduced to powder, for most purposes it will be more convenient to keep it in the state of a precipitate.

It may also be extracted from Storax, and all the other balsams, particularly those of Tolu or Peru; and from the urine of children, and of herbivorous animals.

The benzoic acid has an agreeable taste and a fragrant smell, especially when heated. It is soluble in alcohol, and in boiling water, but very sparingly in cold water, although it may be suspended in it, by means of sugar, so as to form an elegant balsamic syrup.

Acidum citricum. *Lond.*
Citric Acid.

Take of

Lemon juice, one pint;

Prepared chalk, one ounce, or as much as may be required to saturate the juice;

Diluted sulphuric acid, nine fluidounces.

To the lemon juice, heated to ebullition, gradually add the chalk, and mix them. Then decant the liquor, and wash the citrate of lime, which remains behind, in repeated waters. Dry it, and then pour upon the dried powder the diluted sulphuric acid; boil for ten minutes, strain it through a cloth with strong expression, and filter through

paper. Evaporate the filtered liquor with a gentle heat, until it form crystals on cooling.

In order to render the crystals pure, they must be dissolved twice, or oftener, in water, filtered each time, evaporated and crystallized.

This process was contrived by Scheele, and was reduced to determinate quantities by Proust, as follows: To 94 parts of lemon juice, 4 parts of carbonate of lime are to be added; the carbonic acid is separated by effervescence, and a quantity of insoluble citrate of lime is precipitated. By evaporating the supernatant liquor, another portion of citrate of lime is obtained. These added together amount to about $7\frac{1}{2}$ parts, and require 20 parts of sulphuric acid, of the specific gravity of 1.15, to decompose them. The sulphate of lime, being nearly *insoluble*, is precipitated, while the citric acid remains in *solution*, and is to be separated by washing, and crystallized by evaporation. If too much sulphuric acid be added, when the liquor is much concentrated, the citric acid is reacted upon, and part of it is charred. In this case a little chalk must be added, to saturate the excess of sulphuric acid. Mr Parker, Tilloch's Journal, vol. xlvi p. 60, on the authority of a manufacturer of citrate of lime in Sicily, has given some curious details on the subject. 74.964 gallons of lemon juice were used, which, with 35.017 pounds of chalk gave 49.902 pounds avoirdupoise of citrate. The quantity of citrate produced by every pound of chalk varied from 19 to 27 ounces, and from every gallon of juice from $8\frac{1}{4}$ to $12\frac{3}{4}$ ounces. This disparity arose from inequality in the acidity of the juice, and from the same quantity of chalk being used with every kind of juice. The chief difficulties of the manufacture consisted in the drying properly the citrate. In some respects this concrete acid is superior, and in others greatly inferior to lemon juice. It has not the flavour; and, what is of more consequence, it has not the freshness or antiscorbutic powers of the fruit; but from its solid form and gradual solution it is convenient, and is excellently adapted for effervescing mixtures. Dr Haygarth found that 26 parts of the solid acid saturates 61 of subcarbonate of potash, 42 subcarbonate of ammonia, and 40 of carbonate of magnesia.

The crystals are permanent, and dissolve in three-fourths of their weight of cold, and half their weight of boiling water. Dissolved in eight waters, it is said to be equal in strength to lemon juice.

Oleum succini et acidum succini. *Ed.*
Oil of Amber and Succinic Acid.

Take of

Amber reduced to powder, and of pure sand, equal parts.

Mix them, and put them into a glass retort, of which the mixture fills one half: then adapt a large receiver, and distil in a sand bath, with a fire gradually increased. At first, a watery liquor will come over, with some yellow oil; then a yellow oil, with an acid salt; and, lastly, a reddish and darkcoloured oil.

Pour the liquor out of the receiver, and separate the oil from the water. Press the acid salt collected from the neck of the retort and sides of the receiver between folds of blotting paper, to free it from the oil adhering to it; then purify it by solution in warm water and crystallization.

Acidum succinicum. *Dub.*
Succinic Acid.

Take of

Amber,

Pure sand, each one pound.

Distil, with a heat gradually increased, an acid liquor, an oil, and a salt discoloured with oil. Let the salt be wrapt up in blotting paper, and compressed, to squeeze out the oil, and be again sublimed.

We are not acquainted with any experiments which determine whether the succinic acid exist as such in the amber, or whether it be a product of the decomposition of the amber by the action of heat; for in the process employed for obtaining succinic acid the amber is completely decomposed.

The sand is added to prevent the amber from running together into masses, and impeding the distillation; but as it renders the residuum unfit for the use of the varnisher, it is not advisable. According to Göttling, this distillation should be performed in a tubulated iron or earthen-ware retort, exposed to the immediate action of the fire; for he says, that in a sand-bath we cannot regulate the heat sufficiently, and that a glass retort is incapable of supporting the necessary temperature.

Besides the succinic acid collected from the neck of the retort, and sides of the receiver, the oil washes down a portion of it into the receiver, and the watery liquor which comes over is saturated with it. But the whole of it may be obtained by agitating the oil with some boiling water, which will dissolve the acid. This solution is then to be added to the

acid liquor, and the acid they contain is easily obtained by evaporation and crystallization. The acid may afterwards be purified by solution in boiling water and crystallization, according to the directions of the colleges.

But even after repeated solutions and crystallizations, a portion of empyreumatic oil still adheres to the acid, and renders it impure. Other methods of purifying it have been therefore attempted. Demachy saturated it with lime, separated the lime by sulphuric acid, and sublimed the succinic acid: Richter saturated succinic acid with potass, decomposed the salt formed with acetate of lead, and disengaged the succinic acid from the lead by means of diluted sulphuric acid: lastly, Morveau asserts that he obtained it in a state of perfect purity, by treating it with nitrous acid. It is often adulterated with muriate of ammonia, sulphuric acid, sulphate of potass, sugar, &c. When pure it is entirely volatile, gives out no ammoniacal fumes when triturated with potass, is not precipitated by solutions of baryta, and is soluble in alcohol.

Succinic acid, although retained in the Edinburgh and Dublin Pharmacopœias, is never used in medicine. It has been rejected from the London.

Chap. III.—ALKALIES, and ALKALINE SALTS.

Aqua potassæ: vulgo Lixivium causticum. *Ed.*
Solution of Potass, commonly called *Caustic Ley.*

Take of
Newly prepared lime, eight ounces;
Carbonate of potass, six ounces.

Put the lime into an iron or earthen vessel, with twenty-eight ounces of warm water. After the ebullition is finished, instantly add the salt; and having thoroughly mixed them, cover the vessel till they cool. When the mixture has cooled, agitate it well, and pour it into a glass funnel, the throat of which is obstructed with a piece of clean linen. Cover the upper orifice of the funnel, and insert its tube into another glass vessel, so that the Solution of Potass may gradually drop through the rag into the lower vessel. As soon as it ceases to drop, pour into the funnel some ounces of water, but cautiously, so that it may swim above the matter in the funnel. The Solution of Potass will again