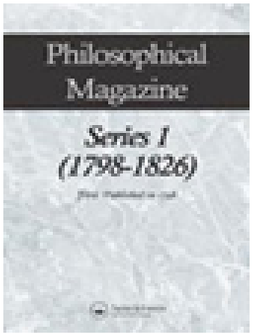

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X. On several new properties discovered in phosphorised hydrogen gas

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the ſecond 356, and the third 600 pounds of ſilk. If the leaves, after the crop has been collected, be thrown together in heaps to rot, they form an excellent manure for future uſe. In regard to the preparation of the ſilk, little is neceſſary to be ſaid. It may eaſily be conceived that it will be of advantage to ſeparate that which is long from the ſhorter part, in order that the former may be employed for ſpinning. The ſhorter kind may be uſed for beds and for hat-making.

This plant may be employed alſo in the manufactory of paper. Schmid, an ingenious paper-maker near Lunenburg, has made ſeveral experiments with the capſules of this plant, which gave the following reſults:

1ſt, From the interior white rind of the capſule, mixed with one-third of rags, he obtained writing-paper pretty white, of a good quality, and ſimilar to the ſilk paper of the Chineſe.

2d, From the external green part of the capſules a greeniſh-coloured paper, which, when ſized, was ſtronger than paper made of rags: it was almoſt as cloſe in its texture as parchment, and even when unſized did not ſuffer the ink to penetrate through it. This kind was exceedingly proper for wrapping-paper.

3d, From the ſtems he obtained a paper ſo like in every thing to common paper made of rags, that the difference could ſcarcely be diſtinguiſhed.

X. *On ſeveral new Properties diſcovered in phoſphoriſed Hydrogen Gas. By* C. RAYMOND, *Profeſſor of Chemiſtry in the Central School of Ardeche*.*

WE are indebted to C. Gengembre for the intereſting diſcovery of phoſphoriſed hydrogen gas. No chemiſt before him had obſerved an elaſtic fluid which, like the one here ſpoken of, poſſeſſes the ſingular property of inflaming by the contact of the air alone, without requiring its temperature to be raiſed, or an ignited body to be preſented to it.

* From the *Annales de Chimie*, No. 105.

The

The kind of undulating and always increaſing ring to which this gas gives birth; when made to burn bubble by bubble in a place where the air is perfectly calm; the ſplendour and magnificence which accompany its combuſtion when effected in oxygen gas perfectly pure; the ſudden penetration of theſe two gaſes, and their total converſion into water and phoſphoric acid; ſuch were the only facts known which had been intereſting to chemiſts in the hiſtory of phoſphoriſed hydrogen gas, when I endeavoured to diſcover whether this elaſtic fluid did not poſſeſs other properties, which, if they did not exhibit ſo brilliant a ſpectacle as the greater part of thoſe above alluded to, might be worthy of engaging the attention of chemiſts.

The property, long known, which ſulphur communicates to hydrogen, and hydrogen reciprocally to ſulphur, of being able to diſſolve together in water, while both taken ſeparately are perfectly inſoluble, had already given me reaſon to think that the caſe might be the ſame with the combination of phoſphorus and hydrogen; and that theſe two ſubſtances, being previouſly united, might perhaps then become ſuſceptible of partaking in the liquidity of water, and communicate to it new properties nearly analogous to thoſe poſſeſſed by that ſolution of ſulphurated hydrogen gas known under the name of *hepatiſed water*.

To deſtroy or confirm this ſuppoſition, I took a glaſs bottle, and, having filled it with newly diſtilled water, inverted it on the ſhelf of a pneumatic tub, in order that I might introduce into it phoſphoriſed hydrogen gas ariſing from the decompoſition of water by a mixture made with phoſphorus and freſh-ſlaked lime. When the bottle was half filled with phoſphoriſed hydrogen gas I removed it from the tub, taking care to ſhut very cloſely its aperture with my finger, while I ſhook it with force in order to effect more ſpeedily an union of the gas with the water, in the ſame manner as the ſolution of carbonic acid gas, as well as that of ſulphurated hydrogen gas, is facilitated by making uſe of the ſame means.

I ſoon perceived, by the ſtrong adheſion of my finger to the mouth of the bottle, that a conſiderable vacuum had been effected in it, and perhaps, even, that the whole of the phoſ-

phoriſed hydrogen gas in it had participated in the liquidity of the water.

I then removed my finger, but not without ſome difficulty, from the mouth of the bottle, that I might examine more accurately the nature and properties of the liquid it contained, and to aſcertain whether there did not yet remain ſome portions of the gas ſuſceptible of inflammation by the contact of the air. But, ſcarcely was the communication eſtabliſhed between the atmoſphere and the inſide of the bottle, when a loud detonation took place, accompanied with a very brilliant light. I readily judged from this phænomenon, that the whole of the phoſphoriſed hydrogen gas had not been abſorbed by the water contained in the bottle; on which account I cloſed the aperture, in order to prevent the combuſtion from being longer continued; which would not have failed to produce a conſiderable quantity of phoſphoric acid, and conſequently to occaſion great uncertainty in regard to the reſults which I wiſhed to obtain.

The bottle having been cloſely ſtopped, I continued to ſhake it ſeveral times, under an idea that I ſhould by theſe means be able to fix entirely the laſt portions of the phoſphoriſed hydrogen gas which had remained undiſſolved.

Hoping that I had ſucceeded, and impatient to know the new properties which the water ſaturated with the gas might have acquired, I determined to unſtop the bottle a ſecond time in contact with the air. This was ſoon followed by a ſecond detonation, ſtronger, indeed, than the former. After this I did not think of ſtopping the aperture of the bottle, ſo that a flame exceedingly pale continued for ſome minutes to iſſue from it.

When I obſerved no more apparent ſigns of combuſtion, I examined by the ſmell and taſte the liquor remaining in the bottle. Its ſmell appeared to me exceedingly diſagreeable, and altogether different from that of gaſeous phoſphoriſed hydrogen; its taſte, though very bitter, had in it, however, ſomething inſipid and diſguſting; and its colour was a little inclining to that of lemon.

When tried with tincture of turnſol it ſoon made it ſenſibly red, which I aſcribed to the ſmall portion of phoſphoric acid which

which muſt have been produced at the moment when the detonations took place, as well as during the diſengagement of the flame which followed the ſecond detonation.

I was then obliged to begin a new operation, that is to ſay, to diſſolve phoſphoriſed hydrogen gas again in water, that I might aſcertain, by employing more caution, in what accurate proportions this ſolution might be effected; and that I might prevent combuſtion alſo from taking place in the inſide of the bottle, which would have become a ſource of error in the concluſion of my experiments.

I had aſcertained with certainty, by means of the quantity of water and gas which I had tried to diſſolve the firſt time, as well as by the detonations which had taken place at the moment when the bottle was unſtopped, that diſtilled water could not diſſolve at the temperature of 47° a volume of phoſphoriſed hydrogen gas equal to its own. I took care, therefore, to introduce into the bottle the ſecond time only about a third of its capacity of the gas. I then repeatedly ſhook the mixture in order to render the union of the gas with the water ſpeedier, and as complete as poſſible; after which I unſtopped the bottle, holding it inverted in a ſmall tub, which I had filled with newly diſtilled water, that I might ſee whether it would become entirely filled with it merely by the effect of the preſſure of the atmoſphere, and that I might thence judge whether the whole gas had been liquefied.

I indeed ſaw a portion of the water in the tub aſcend into the bottle, but I perceived alſo that it was not entirely filled; which confirmed me in the opinion that there ſtill remained a portion of the gas which had not participated in the liquidity of the water. Having then tried to make ſome bubbles of it iſſue out through this liquid, theſe bubbles inflamed ſpontaneouſly by the contact of the air alone; which proved to me that the phoſphoriſed hydrogen gas had not been decompoſed at all by agitation, nor by its contact with diſtilled water; whereas it ſoon loſes its highly combuſtible property when collected in bottles filled with water which has not been diſtilled, or diſtilled water which has been long kept, which I aſcribe to the quantity of air which common water always holds

holds in ſolution, the oxygen of which, joining a portion of the phoſphorus, effects its ſeparation from the hydrogen by converting it into phoſphorous oxyd, which being altogether inſoluble, depoſits itſelf on the ſides of the veſſel, without any appearance in this kind of oxydation of any ſenſible ſign of combuſtion; while the oxygen of the atmoſpheric air, which participates in the liquidity of the water, being always in that caſe deprived of a large portion of the light and caloric which are combined with it in its aërial aggregation, cannot produce theſe two effects in a very ſenſible manner when it paſſes in this ſtate of liquid aggregation from one combination to another.

Having again agitated the bottle after cloſing the mouth of it, I was able, by means of the ſmall quantity of water which had been introduced into it, and of which I kept an exact account, to render the abſorption of the laſt portions of the gas complete; for, having a ſecond time uncorked the bottle in the ſame diſtilled water, I then ſaw it become entirely filled. I think I may affirm, therefore, from theſe trials, and ſome others which I made, that water freed from air by diſtillation can diſſolve and liquefy, at the uſual temperature, a little leſs than the fourth of its volume of phoſphoriſed hydrogen gas, and that with this doſe it is completely ſaturated.

This ſolution thus prepared, and kept free from the contact of the air, always exhibited the following properties:

In colour, it has a pretty near reſemblance to ſulphur in ſticks, though a little leſs dark; it has a ſtrong diſagreeable odour, and an exceedingly bitter, nauſeous, and diſguſting taſte.

When examined in the dark, this ſolution does not appear luminous; which proves that the phoſphorus is intimately combined in it with the hydrogen.

When diſtilled in a ſmall retort, connected with a pneumatic apparatus, it furniſhes, at a temperature a little above that of boiling water, and eſpecially when diſtilled ſoon after it has been prepared, a very large quantity of phoſphoriſed hydrogen gas, as pure and as combuſtible as that obtained by heating cauſtic alkalies, or quicklime, with phoſphorus and a very ſmall quantity of water: what afterwards

wards remains in the retort after the diſengagement of this gas has entirely ceaſed, is nothing elſe than pure water, having neither odour, taſte nor colour, and perfectly reſembling water newly diſtilled.

When brought into contact with atmoſpheric air, this ſolution ſoon ſuffers to be depoſited a remarkable quantity of red oxyd of phoſphorus, and at the ſame time ſuffers to be diſengaged hydrogen gas, which is no longer ſuſceptible of inflammation, except when brought into contact with a body in a ſtate of ignition. If the ſolution be long expoſed to the air, and if the points of contact be frequently renewed by agitation, it becomes completely decompoſed; that is to ſay, is entirely reſolved into phoſphorus, oxyd, and pure hydrogen gas.

Tincture of turnſol and that of violets experience no change in their colour from being in contact with liquid phoſphoriſed hydrogen; which proves that this liquor is neither acid nor alkaline.

The ſulphuric and nitric acids, or the ſimple or oxygenated muriatic, when poured over this liquor, produce no effect worthy of notice.

Potaſh, ſoda and ammonia act in the ſame manner.

The oxyds of mercury and lead are ſpeedily reduced, and immediately converted into metallic phoſphurets, by being mixed with the ſolution of phoſphoriſed hydrogen gas.

When poured into nitrat of ſilver, this ſolution immediately produces a very abundant black precipitate, which does not in the leaſt change its colour, and which, when tried by the blow-pipe, exhibits the characters belonging to metallic phoſphurets.

When brought into contact with a ſolution of mercury by nitric acid, it gives alſo immediately a very conſiderable precipitate, which has firſt a black colour, but which becomes white and cryſtalliſed in proportion as it paſſes from the ſtate of phoſphuret to that of mercurial phoſphat, by imbibing oxygen, either from the nitric acid in which the precipitation takes place, or from the atmoſpheric air with which it is in contact.

A ſolution of lead by the nitric acid is alſo decompoſed

by the hydro-phoſphorous liquor, but with leſs force than the ſolutions of ſilver and mercury are. There is formed in this decompoſition alſo phoſphuret of lead, which in the courſe of time is converted into a phoſphat.

The ſulphat of copper ſhows alſo, at the end of a certain time, a pretty abundant black precipitate when poured into a ſolution of phoſphoriſed hydrogen. This precipitate, like that obtained by the decompoſition of nitrat of ſilver, retains its colour; which may give us reaſon to believe that it can be converted only with difficulty into a phoſphat.

Sulphat of iron did not appear to me to experience any ſenſible decompoſition till the end of ſeveral days. Nitrat of arſenic, poured into this liquid, did not experience any ſenſible decompoſition till the end of ſeveral days. There was then formed a precipitate of a very beautiful yellow colour under the form of ſmall grains, and which could remain a long time expoſed to the air without experiencing any kind of change. This precipitate was an arſenical phoſphuret.

It reſults from theſe new properties, firſt diſcovered, I think, by myſelf, in phoſphoriſed hydrogen gas, 1ſt, That this gas can unite itſelf to diſtilled water, in the proportion of about a fourth of its volume, when the ſolution is effected at the temperature of 44·5 of Fahrenheit's thermometer *. 2d, That this gas communicates to the water in which it is diſſolved a ſtrong diſagreeable odour, as well as a bitter taſte, which may one day make it be employed with ſucceſs in the treatment of many diſeaſes, either on account of the facility with which this preparation ſuffers itſelf to be decompoſed, or of the part performed by the phoſphorus it contains in the formation of animal matters. 3d, That when water well freed from air has been employed to liquefy this gas, and when care has been taken to keep it thus diſſolved in bottles well corked, it may be preſerved a long time without experiencing decompoſition, ſo that by heating the ſolution you may extract from it, in the ſtate of gas, all the phoſporiſed hydrogen it contains. 4th, That when

* It is probable that at the temperature of freezing water might diſſolve a larger quantity, but the want of phoſphorus prevented me from aſcertaining this fact.

the

the water has thus been freed from all the phoſphoriſed hydrogen it had diſſolved, it becomes pure water; which proves that it was indebted for its new properties to the preſence of this gas alone. 5th, In the laſt place, that this ſolution is capable of ſpeedily reducing ſeveral metallic oxyds, whether alone or diſſolved by acids, and of forming with them, by means of double electrive attraction, water and metallic phoſphurets, combinations which hitherto have been obtained only in the dry way; that is to ſay, by heating metals with phoſphorus, or by decompoſing phoſphoric glaſs or metallic phoſphats by metals and charcoal. Such are the properties which appear to me ſufficiently intereſting to be worthy of being added to the ſtill imperfect hiſtory of phoſphoriſed hydrogen gas.

XI. *On the general Nature of Light.* By Mr. Robert Heron. *Communicated by the Author.*

THROUGH the medium of the Philoſophical Magazine I beg leave to lay before men of ſcience the following opinions, which have lately ſuggeſted themſelves to me as neceſſary and fair inductions from thoſe facts that have come to my knowledge reſpecting light.

1. Light paſſes only through the vacuities in other bodies; does not penetrate their ſolid ſubſtance, ſo as ever to coexiſt with it in the ſame place.

2. It paſſes through thoſe vacuities in ſtraight perpendicular lines, without any loſs of its qualities by attenuation and ſubdiviſion of its particles: or, it is refracted from the perpendicular with a ſubdiviſion of its particles, by which its qualities are altered: or, its paſſage is wholly interrupted, and it is either reflected or abſorbed.

3. Since general attraction acts in bodies in the proportion of their maſſes and aggregation; ſince the more the affinity of aggregation is in any bodies deſtroyed, ſo much the more readily and powerfully do the chemical affinities of compoſition act upon them; ſince the extreme tenuity of light,