

zinc. The ability of zinc to decompose oxide of lead may be shown in what is called a

Table of Decomposition.

Oxygen.

Zinc.
Lead.

The metal whose oxide is decomposed more easily is placed below. When you find this list extended, as is generally the case in text books, so as to include all the metals arranged according to their affinities for oxygen, you should copy it, and post it up in the dyehouse.

You can also determine whether the affinity between the oxide of lead and acetic acid is greater or less than that which exists between that oxide and some other acid, for example, sulphuric.

Experiment 4.—To the teaspoonful of acetate of lead which you poured into a wine glass and kept covered, add about a tablespoonful of pure water, and then add a few drops of sulphuric acid. The solution, previously clear, instantly becomes turbid, and a heavy white powder sinks to the bottom.

Explanation.—This powder is the insoluble sulphate of lead. Sulphuric, the master acid, unites with the oxide of lead, liberating the acetic acid, which remains in the solution. The action may be thus expressed: Acetate of Lead + Sulphuric Acid = Sulphate of Lead + Acetic Acid; or, further to aid the memory in the form of a table of decomposition:

Oxide of Lead.
Sulphuric Acid.
Acetic Acid.

When an acid combines with an oxide of a metal the resulting compound is called a salt, and you have here the decomposition of one salt, the acetate of lead, by a stronger acid than the acetic, and the formation of another salt, the sulphate of lead.

The affinity of the oxides of zinc and of lead for the acetic, a vegetable acid, you have seen to be quite marked, but their attraction for vegetable dyes is too weak to merit your attention now. The oxide of aluminum, known as alumina, has, on the contrary, a powerful attraction for those dyes, as a few days' experience at the dye vat will teach you. But this attraction for the several vegetable coloring principles is not equal, and you may measure its relative power as readily as you can that of an oxide for an acid. Nor need you specially prepare your alumina. You have but to take advantage of its preparation for use on a large scale, and have a test piece of cotton cloth "mordanted" with the other goods. With this piece you may test the relative attraction of alumina for at least three important vegetable dyes, viz., quercitron, logwood, and madder.

Experiment 5.—First immerse the cloth mordanted with alumina in a decoction of quercitron bark. This imparts to it a fast yellow color. Wash well, then put it into a hot decoction of logwood. The color of the cloth will gradually be changed from yellow to purple. Rinse, and immerse it for several hours in a hot solution of madder, and the purple cloth will become red.

Explanation.—The yellow compound of alumina and quercitron, when immersed in the decoction of logwood, was decomposed; the quercitron being set free by the greater attraction existing between logwood and alumina. So when the purple cloth is kept in the hot solution of madder, the superior attraction of this dye for alumina sets free the logwood.

You are, therefore, with alumina and the three dyes, able to make the following table of decomposition:

Alumina.
Madder,
Logwood,
Quercitron.

The dye which has the greatest attraction for the metallic oxide being placed first under it, the others following in order.

The formation of litharge in the first experiment illustrates how oxides are composed. The production of the acetate of lead in the second experiment, by the union of the oxide of lead with the acetic acid, shows how a salt is formed by the combination of an acid with a metallic oxide. The separation of oxygen from lead in the third experiment, by taking advantage of the superior affinity existing between zinc and oxygen, is a case of chemical decomposition well worthy of repetition. It is one of a large number of interesting transformations of oxides. The decomposition of the acetate of lead in the fourth experiment by the stronger attraction of sulphuric acid for the oxide of lead, the formation of the insoluble sulphate of lead, and the consequent setting free of the acetic acid, elucidate the transformations of mineral salts; while the fifth experiment carries these transformations among the coloring matters, and demonstrates that the laws of decomposition control the operations of the dye vat.—*Textile Record.*

ON THE ACTION OF OILS ON METALS. *

By WILLIAM HENRY WATSON, F.C.S., etc.

At the Plymouth meeting of this association I brought forward the results of some experiments, showing the actions of various oils on copper, and the conclusions arrived at were briefly these:

1. That of the whole of the oils used, viz., linseed, olive, colza, almond, seal, sperm, castor, neatsfoot, sesame, and paraffin, the samples of paraffin and castor oils had the least action, and that sperm and seal oils were next in order of inaction.

2. That the appearances of the paraffin and the copper were not changed after 77 days' exposure.

3. That different oils produce compounds with copper varying in color, or in depth of color, and consequently rendering comparative determinations of their action on that metal from mere observations of their appearances impossible.

I was disposed to conclude that these experiments would indicate the relative action of the oils on other metals, simply expecting that the extent of action would vary throughout, but that the variations would be proportionate between the different oils.

Since the publication of these results, however, an interesting paper has appeared (*Pharm. Journ.*), "On the Action

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of Paraffin Oils on Metals," by Dr. S. Macadam. He comes to the same conclusion as myself with regard to their action on copper, but referring to iron, says "it is slightly affected by paraffin oil, and on ten days' contact the oil becomes deeper in color and throws down a fine ferruginous sediment." Owing to this, I have lately made experiments on the action of the same oils as those previously used on copper, on iron, and the results, which are the subject of this communication, are interesting to me as showing that there is no relation between the action of an oil on copper and the action of that oil on iron; that, in fact, in several instances those oils which act largely on iron, act slightly on copper, while those which act largely on copper act little on iron. Of course the actual extent of action of the same oil (with the exception of paraffin) is greater on copper than on iron.

In addition to the oils used in my experiments on copper, I also used a sample of refined lard oil, and a special lubricating oil prepared by the Dee Oil Company, near Chester. The following observations were made, after twenty-four days' exposure:

1. *Neatsfoot.*—Considerable brown irregular deposit on metal. The oil slightly more brown than when first exposed.
2. *Colza.*—A slight brown substance suspended in the oil, which is now of a reddish brown color. A few irregular markings on the metal.
3. *Sperm.*—A slight brown deposit, with irregular markings on the metal. Oil of a dark brown color.
4. *Lard.*—Reddish brown, with slight brown deposit on metal.
5. *Olive.*—Clear and bleached by exposure to the light and air. The appearance of metal same as when first immersed.
6. *Seal.*—A few irregular markings on metal. The oil free from deposit, but of a bright clear red color.
7. *Linseed.*—Bright deep yellow. No deposit or marks on metal.
8. *Almond.*—Metal bright. Oil bleached and free from deposit.
9. *Castor.*—Oil considerably more colored (brown) than when first exposed. Metal bright.
10. *Paraffin.*—Oil bright yellow and contains a little brown deposit. The upper surface of the metal on being removed is found to have a resinous deposit on it.
11. *Special Lubricating.*—Metal bright. Appearance of oil not perceptibly changed.

The samples were then chemically examined, and the amounts of iron found in them were as follows:

Neatsfoot oil (English).....	0.0875 grain.
Colza ".....	0.0800 "
Sperm ".....	0.0460 "
Lard ".....	0.0250 "
Olive ".....	0.0062 "
Linseed ".....	0.0050 "
Seal ".....	0.0050 "
Castor ".....	0.0048 "
Paraffin ".....	0.0045 "
Almond ".....	0.0040 "
Special lubricating oil.....	0.0018 "

For comparison, the following are the results obtained of the action of these oils on copper, as previously communicated, after exposure of ten days:

	Copper found.
Neatsfoot oil.....	0.1100 grain.
Colza ".....	0.0170 "
Sperm ".....	0.0030 "
Olive ".....	0.0200 "
Linseed ".....	0.3000 "
Seal ".....	0.0485 "
Paraffin ".....	0.0015 "
Almond ".....	0.1030 "

Owing to the length of exposure being different in the two series, we cannot fix on the actual differences in the rate of action of any of the oils on the two metals. However, it is shown that almond oil, which acted largely on copper, acts very slightly on iron; in fact, with the exception of the paraffin and special lubricating oil (a mineral preparation), it acted less than any of the other oils on iron. The same is shown, as already mentioned, as to the action of various other oils; thus, while sperm oil acts slightly on copper, it acts considerably, compared with the others, on iron. Linseed, seal, castor, almond, and paraffin may be bracketed as having about the same and very little action on iron, while linseed, olive, neatsfoot, almond and seal have the greatest action on copper.

PRUSSIC ACID AND A NEW ALKALOID IN TOBACCO SMOKE.

DR. LE BON has communicated to the *Journal de Therapeutique* a paper "On the Existence in Tobacco Smoke of Notable Proportions of Prussic Acid, and on the Existence of a New Alkaloid." He comes to the following conclusions:

1. The principles of tobacco smoke, which are condensed by cooling in the mouth and lungs or in the apparatus destined to collect them, contain nicotine, carbonate of ammonia, various tarry matters, coloring substances, prussic acid combined with bases, and very odorous and very poisonous aromatic principles. In the smoke these various substances are found mixed with a large proportion of the vapor of water and of various gaseous compounds, principally the oxide of carbon and carbonic acid.

2. The liquid resulting from the condensation of the preceding substances is endowed with extremely poisonous properties. It suffices to inject very small quantities into the circulatory system of an animal, or to cause it to be respired for some time, to induce death, after the exhibition of various signs of paralysis.

3. The properties of tobacco smoke, which up to the present time have been attributed solely to nicotine, are also due to prussic acid and to various aromatic principles, especially an alkaloid, *collidine*. This is a liquid body of an agreeable and very penetrating odor, the presence of which had been exhibited in the distillation of various organic matters, but the physiological properties of which were entirely unknown. It contributes in great part to giving its odor to tobacco smoke; and so penetrating is its perfume that but a single drop suffices to impart a very strong odor to a large quantity of water.

4. *Collidine* is an alkaloid as poisonous as nicotine. The twentieth part of a drop kills a frog rapidly, producing symptoms of paralysis. Only a few instants breathing it induces muscular debility and vertigo.

5. It is to the presence of prussic acid and the various

aromatic principles that several phenomena are due, such as vertigo, pain in the head, and nausea, which are produced by certain tobaccos, either poor in nicotine or destitute of it, while other tobaccos, rich in nicotine, do not produce any analogous effects.

6. The proportion of prussic acid and aromatic principles contained in tobacco smoke varies in different tobaccos, those of Havana and the Levant containing the strongest doses.

7. The black semi fluid matter which condenses in the interior of pipes and cigar holders contains all the substances enumerated, and especially large quantities of nicotine. It is extraordinarily poisonous, two or three drops sufficing to kill an animal of small size.

8. The combustion of tobacco destroys only a small part of the nicotine which it contains, so that this is found in great part in the smoke. The proportion susceptible of being absorbed by smokers, and which we have determined in our experiments, varies according to the conditions in which these latter are placed. It is scarcely ever less than 50 centigrammes in each 100 grammes of tobacco smoked. The quantity of ammonia absorbed at the same time is about equal.

9. Of the different modes of smoking, that in which the amount of nicotine and the various other principles absorbed is greatest, is smoking so that the smoke is respired; that in which the proportion is least, is smoking the narghal or pipe with a long tube in the open air, without respiring the smoke.

10. Nicotine kills animals instantly in doses of two or three drops, but in infinitely smaller doses it causes paralysis and death. A frog introduced into a vessel containing an aqueous solution of nicotine at one-two hundred thousandth, or about one drop to a liter of water, succumbs in some hours. The same occurs if the frog be placed under a funnel containing a single drop of nicotine in a roll of cotton wool. The vapor disengaged from nicotine while boiling kills animals instantly, without leaving them time to move.

11. Tobacco smoke contains about eight liters of oxide of carbon per 100 grammes of tobacco burned. Our experiments prove that it is not to this gas that it owes its poisonous properties.

12. Among the most certain effects which the smoke of tobacco determines in the long run in man, may be mentioned visual disturbances, palpitations, tendency to vertigo, and especially diminution of memory.

LIQUEFIED OZONE.

It has been recently found by MM. Hautefeuille and Chappuis that the production of ozone in oxygen by the silent electric discharge in M. Berthelot's apparatus for that purpose is greatly influenced by temperature. Thus in passing from 20° to -55° the proportion of ozone obtained was nearly quintupled. Increase of pressure has a like effect, but much less in amount for each temperature. By reason of these observations the authors have been enabled to submit portions of largely ozonized oxygen to the action of increasing pressures in M. Cailletet's apparatus (in which it is known mercury acts by pressure on a gas in a strong capillary tube). The capillary tube was kept at a temperature of -23°. From the first strokes of the piston the gas in the tube assumed a blue color, deepening to indigo blue when the tension of the ozone had reached several atmospheres. A sudden decompression or release of pressure from 75 atmospheres, gives rise to a thick, blue mist, a certain sign of liquefaction of the ozone. To get a corresponding mist with pure oxygen requires a previous compression to 3.0 atmospheres. On the other hand, ozone seems a little less easy to liquefy than carbonic acid. It would appear, further, that ozone is to be numbered among explosive gases. If the mixture of oxygen and ozone referred to be not compressed slowly and kept cool, the ozone is decomposed with liberation of heat and light. A strong detonation is heard, accompanied by a yellowish flash. The blue color (it is remarked) is as characteristic of ozone as the odor of the gas, for it may be observed with all tensions, if a sufficient thickness of the gas be looked through.

ACTION OF SULPHURIC ACID ON PLATINUM.

By SCHEURER-KESTNER.

THE action of chamber vitriol on the platinum retorts used in the process of concentration is due to the presence of a very minute trace of oxides of nitrogen, which give scarcely any reaction with ferrous sulphate, but may be detected by means of the blue color formed by diphenylamine. The solvent action is greater the greater the concentration of the acid. The oxides of nitrogen exist in the oil of vitriol in presence of selenium and sulphurous anhydride, and are apparently in a state of stable combination, since they are not expelled during the process of concentration, whereas all the sulphurous anhydride is given off. A very minute trace of nitrogen oxides, which appear to act as intermediate agents in the oxidation of the platinum at the expense of the oxygen of the sulphuric acid, is consequently sufficient to cause continuous solution of the platinum so long as the oil of vitriol remains in contact with it. If, however, the oil of vitriol be previously boiled with a little ammonium sulphate, all the oxides of nitrogen are destroyed, and the action on the platinum is prevented. Perfectly pure sulphuric acid does not attack platinum even when heated with it in closed tubes at the boiling point of sulphur.—*Compt. Rend.*

SULPHUR IN COAL.

By W. WALLACE.

It has been assumed that sulphur exists in coal chiefly, if not entirely, as iron bisulphide. Crace-Calvert has asserted that in some cases it is partly present as sulphates. The author shows that in some coals the sulphur chiefly exists as an organic compound. The following table shows the relative quantities of total sulphur and that existing as pyrites, assuming all the iron found in the ash to have been present as bisulphide:

	Total sulphur per cent.	Sulphur as bisulphide per cent.
Ell coal (Lanarkshire)....	0.91	0.11
Main coal ".....	0.60	0.42
Splint ".....	0.46	0.14
Pyotshan ".....	0.68	0.17
Soft coal from Fife.....	0.93	0.49

The estimations of sulphur were made by Pattinson's method, and also by fusion with sodium carbonate and potassium nitrate. The Ell coal was found by Crace-Calvert's method to be free from sulphates, the others were not tested.—*Chem. News.*