(b) Soluble in ether forty-four per cent.; formula, $C_{24}H_{24}S_2$.

(c) Insoluble in above, soluble in chloroform fifty-two per cent.; formula, $C_{22}H_{24}S_2$.

(b) Melts at $65^\circ C$; (c) at $156^\circ C$.

ANALYSIS OF TRINIDAD ASPHALTUM.

(a) Soluble in alcohol five per cent.; formula, $C_{20}H_{20}S$.

(b) Soluble in ether fifty-seven per cent.; formula, $C_{22}H_{24}S$.

(c) Insoluble in above, soluble in chloroform thirty-eight per cent.; formula, $C_{22}H_{24}S_2$.

(b) Melts at $54^\circ C$; (c) at $150^\circ C$.

The proportions vary with the different sorts of asphaltum, as in the case of the asphaltum from Bechebroun (Bas Rhin), which virtually consists of carbureted hydrogen, while Maracaibo asphaltum behaves analogously with that from Trinidad and Syria. Asphaltum from Barbadoes occupies a middle place between that from Bechebroun and that from Syria. The photo-chemical behavior of asphaltum is of great interest, but on that point we shall quote from Dr. Kayser himself:

"Until now it has been assumed (apparently under the influence of the idea that asphaltum itself is to be looked upon as the product of the oxidation of earthy oily bodies—that is to say, of heavy carbureted hydrogen) that an oxidation of asphaltum takes place under the influence of light, and that this oxidized asphaltum has lost its solubility.

"It was, however, proved by these experiments that in Syrian and Trinidad asphaltum—these being the kinds which principally find their way into the markets and are used in photography—no oxygen is contained, but that they should rather be considered as sulphureted hydrocarbons; therefore, the view of exposure to light causing oxidation is not very tenable, even if not altogether excluded."

The elementary composition of Syrian and Trinidad asphaltum he gives as follows:*

	Syrian asphaltum.	Trinidad asphaltum.
Carbon	80.0 per cent.	78.8 per cent.
Hydrogen	9.0 "	9.3 "
Sulphur	10.0 "	10.0 "
Nitrogen	0.6 "	0.5 "
Ashy residue	0.4 "	1.4 "
	100.0	100.0

"In order to examine the question more closely, and so perhaps to find the answer to it, the following experiment was undertaken: Five grammes of picked pieces of Syrian asphaltum were dissolved in two hundred grammes of pure chloroform, and with the solution some glass plates (the exact weight of which had been previously ascertained) were coated on one side, and, after the chloroform had evaporated, the plates on which the coating of asphaltum had remained were dried in a dark room at $100^\circ C$ until they reached their constant weight. The asphaltum film transmitted the light of a pale brown color, and when dry was very easily dissolved in oil of turpentine, or in a mixture of two parts of oil of turpentine and one part of olive oil. The plates so prepared with their coating of asphaltum were exposed for several days to light—often, indeed, to the direct light of the sun—in the month of June, and, therefore, in a month during which the average daylight is powerful. During this time the plates were weighed twice a day—at midday and at five in the afternoon; but in no case was any observable alteration of weight, either increase or decrease, to be detected in the asphalted glass plates, even after seventy-two hours of exposure, after which time the asphaltum film had become insoluble in the above mixture of olive oil and turpentine.

"As the quantity of asphaltum on each plate varied from three to five decigrammes, even a very slight increase caused by the action of the oxygen of the air would have revealed itself by a change in the weight, especially if actual oxidation—that is, incorporation of oxygen in the substance of the asphaltum—had taken place. As, therefore, an oxidation of the asphaltum by the agency of light cannot very well be predicated, there remains almost no other explanation than that by the agency of light a molecular change has been operated in its components, by which its physical properties are changed. Of analogous examples of the action of light not a few are known; for instance, the change of anthracene into paranthracene by sunlight offers an example of a body which loses its solubility through the action of light and is converted into an isomorphous or polymorphous body, and behaves quite differently with chemical reagents from what it did before. The above example is especially applicable in this case, as by heating to its melting point paranthracene is reconverted into anthracene and regains its solubility; in the same way, the asphaltum which has become insoluble again becomes soluble when heated to fusion.

"It is further known that under the action of light, when air is completely excluded, the formation of colored resinous substances, forming carbureted hydrogen, takes place in commercial petroleum, and that such formations are accelerated and intensified by the action of direct sunlight. Whether or no the formation of such resinous substances in petroleum is not connected with the sulphur it contains,† even though that should be very small in quantity, must remain unanswered for the present.

"The action of light upon asphaltum, with regard to its components, is not confined to thin films freed from their solvent, but extends to the same while still remaining in solution. Supposing a well closed white glass vessel, filled with a moderately concentrated filtered solution of asphaltum in oil of turpentine, or with a filtered ethereal extract, or only with the part insoluble in ether dissolved in oil of turpentine or chloroform, to be exposed for some time to sunlight: in every case there will be resinous precipitates which will have lost their solubility in their respective solvents. The greater part of this precipitate adheres fast to the sides of the vessel; a smaller portion remains suspended in the solution. Solutions of asphaltum or of its component parts should, therefore, be stored in the dark, since the precipitate (especially the part held in suspension) must have an injurious effect on its photographic employment.

"As the examination of the asphaltum from Syria and Trinidad has shown that it consists of at least three differently composed forms of sulphureted carburet of hydrogen, the next thing to discover was whether the photographic properties of the asphaltum belonged to the three components collectively, or only to certain individual components. The solution of this problem was also sought for experimentally, in a way similar to that already described. For this purpose solutions were prepared of the three isolated

components of both Syrian and Trinidad asphaltum, five parts of weight of each being dissolved in 200 parts by weight of chloroform, and glass plates were coated with the solutions and treated as already described.

"After a three hours' exposure to the light of the sun the asphalted glass plates were taken into a dark room and treated with the already mentioned mixture of oils (oil of turpentine two parts, olive oil one part), the plates being several times coated with it, and then left for a few minutes to allow it to act. The solvent was now allowed to run off and then washed with petroleum ether.

"In the case of the substances soluble in alcohol no change was observable in the oily coating, and it had retained its perfect solubility. The substance soluble in ether had only partially and incompletely dissolved. The film of the substance insoluble both in ether and alcohol remained undissolved, even after the solvent had been allowed to act upon it for a long time.

"From this experiment it follows that the property of sensitivity to light belongs to the substance soluble in ether and to the insoluble substance, and that the property is present in the highest degree in the substance which is insoluble in ether and which is present in both sorts of asphaltum with the composition $C_{22}H_{24}S_2$.

"It follows, further, that as the quantitative proportion of the individual components varies in the different sorts, the asphaltum which contains the largest proportion of the substance, $C_{22}H_{24}S_2$, will be the most sensitive to light, and as Syrian asphaltum contains fifty-two per cent. of it, and the Trinidad only thirty-eight per cent., the former must be regarded as the more sensitive of the two—a conclusion which finds a practical confirmation, as if two glass plates (one coated with Trinidad and the other with Syrian asphaltum) be exposed to light, and their behavior towards the solvent oils tested at short intervals, it will always be found that the plate coated with Syrian asphaltum shows insolubility even while the other is still soluble. Based on the foregoing observations Syrian asphaltum would appear to be the most suitable for photographic use, if in future it is not thought advisable first to eliminate, by treatment with ether, the substances soluble in alcohol and in ether, so as to employ exclusively those components which possess the greatest sensitiveness to light."—*Photographische Mittheilungen*.

PICTET'S CALORIFIC SYNTHESSES.

PICTET modifies Mossotti's hypothesis, by supposing that atoms attract each other as well as attracting ether. He regards the gaseous atom as simple, the liquid molecule as composed of at least two gaseous atoms, and the solid molecule as containing at least two liquid molecules. Starting from the amplitude of calorific oscillation, he explains, by simple mechanical laws, the law of Mariotte and Gay Lussac, the anomalies with their limits and the conditions of passage from the gaseous to the liquid state, the mobility of liquids, their feeble compressibility, their diffusion and volatilization; the rigidity, elasticity, hardness, axes of crystallization, allotropism and amorphism of solids; the absolute zero temperature, thermic equilibrium and specific heat of bodies; the law of Dulong and Petit; fusion, evaporation, latent heat, density, vapor-tension, and nearly all the phenomena of thermo-chemistry. He thinks it probable that the dimensions of atoms and molecules may be deduced from his experiments.—*Bull. de la Soc. Vaud.*

ON A NEW HYDRIDE OF SILICIUM.

By M. J. OGIER.

1. I HAVE submitted pure siliciureted hydrogen to the action of the electric effluvium.* After a sufficient time this gas is entirely destroyed; a yellow coating is formed in the interior of the tubes, and the volume of the gas increases up to an apparently constant limit.

2. The residual gas does not contain a trace of silicium, but it is simply pure hydrogen.

The ratios between the volumes of the siliciureted hydrogen used, and the hydrogen resulting from its decomposition, have been found in five different experiments to be:

$$\frac{1}{1.21}, \quad \frac{1}{1.22}, \quad \frac{1}{1.21}, \quad \frac{1}{1.29}, \quad \frac{1}{1.26}$$

From these results it is easy to find the composition of the solid which was left on the glass, which contains the remainder of the hydrogen, united with all the silicium. In this way we arrive at the following formulæ ($Si = 28$):

These figures answer very nearly to the composition of Si_2H_3 . The body under examination will, therefore, be a subhydride of silicium, corresponding to the suboxide of carbon, or again to crotonylene, in the series of carbureted gases.

3. Some of the properties of this body are as follows: When moderately heated in air it burns, throwing off small sparks. The combustion takes place spontaneously when hit with a hard body, or when rubbed with a steel blade. This subhydride is inflammable in chlorine when cold. When heated cautiously in an atmosphere of hydrogen or nitrogen, it evolves siliciureted hydrogen, easily recognized by its spontaneous inflammation in the air; a higher temperature only causes a deposit of silicium with the evolution of hydrogen.

4. We have seen that the electric effluvium at a high tension produces effects on siliciureted hydrogen, analogous to those which it produces on formene (the formation of acetylene, and a condensed carbide having a smell like turpentine, according to M. Berthelot). The analogy rests, if we study the fixation of nitrogen, by the effluvium on the siliciureted gas. In fact, a mixture of equal volumes of nitrogen and siliciureted hydrogen gave after the action of the effluvium a residual gas, consisting of hydrogen, nitrogen, and ammonia, which latter was easily detected by means of hydrochloric acid; but the ammonia was present in a very minute quantity, in fact it was hardly one per cent. of the residue.

On the other hand, the solid matter had equally absorbed a small quantity of nitrogen, which was evolved as ammonia by means of melting pot sh. This is exactly what was observed when the mixture of formene and nitrogen was submitted to the action of the electric effluvium.

5. I have experimented to see if any analogous hydride would be produced when siliciureted hydrogen is carefully heated. This gas is almost as stable as the corresponding carbides of hydrogen, for it will stand a temperature of

nearly 400° before beginning to decompose. Keeping it at this temperature, I observed after a quarter of an hour a decomposition of more than 10 per cent.; after an hour the destruction was almost complete. Thus the siliciureted hydrogen resolves itself, purely and simply, into silicium and hydrogen without forming any intermediate hydrides as the carbides of hydrogen do.

6. I have similarly studied the action of the effluvium on arseniureted hydrogen; it also forms a solid hydride As_2H_3 , corresponding to the solid phosphide of hydrogen, P_2H_3 .—*Comptes Rendus*.

STARCH AND ITS TRANSFORMATIONS.

By H. T. BROWN and J. HERON.

AFTER a survey of the results obtained by former experimentalists, the authors describe the methods they have used for the purification of starch, for the preparation of starch-paste, and the preparation and analysis of the extract of malt, and the analysis of the transformation products of starch. They then examine the behavior of starch, with the extract of malt, after a preliminary notice of the changes undergone by a cold infusion of the latter, its fermentation in the cold, and its behavior when heated. They find that the invertive action of the malt ferment is most powerful about 55° , and ceases to act almost entirely at 60° . They then turn to the nature and properties of starch and starch cellulose, and the separation of a second body. They treat of the different glutinosity of starch paste as occasioned by very slight differences in the manufacture of the starch. They describe the sp. gr. of starch in the form of paste, the solubility of granules, the optical activity of starch-paste, its behavior with potassa; the properties of maltose, its reaction with dilute sulphuric acid and with extract of malt; the behavior of the latter with starch, distinguishing the various kinds of grain; the action of extract of malt upon bruised starch, upon starch paste in the cold, describing the reaction as rapid and energetic; the behavior of malt extract upon starch paste in heat at a number of specified temperatures. They then treat of the detection of soluble starch or achroodextrin in presence of erythro-dextrin; the influence of neutralization upon the activity of extract of malt, the molecular transformations of starch. They examine if dextrose is a product of the action of malt-extract upon starch, and reply in the negative, the product formed being maltose. Finally they discuss the nature of diastase.

CERTAIN ULTRAMARINE COMPOUNDS.

By K. HEUMANN.

THE author concludes that in a successful operation in a sealed tube, the reaction of silver nitrate upon blue sodium ultramarine is a very complete substitution of the sodium by an equivalent weight of silver, the subsidiary reactions being so trifling that they may be overlooked. The yellow silver ultramarine is beyond doubt a silver compound, corresponding to the blue sodium ultramarine. The author considers that a quantitative study of the various reactions of silver ultramarine will be of great value for throwing a light on the nature of the ultramarine compounds.

OIL OF TURPENTINE FROM PINE CONES.

IN some districts of Thuringia, Germany, it has been customary for a long time to utilize pine cones for the preparation of oil of turpentine. The pine cones are sold by the forest officials on account of government, and are collected by gathering from the trees before they are completely ripe. They are then stored in flat sheds, lightly covered with brush, for three to five months, until they have become thoroughly loose. The apparatus used for distilling the oil of turpentine consists of a kettle, *a*, set in brick, surmounted by a tight fitting copper head, *b*, from which two tinned iron tubes, *c*, about the caliber of rifle tubes, project downward, and are

joined to similar tubes passing upward through the condensing barrel, *e*, and meeting them. The condensed liquid runs through a funnel, *f*, into the glass globe, *g*, which has an opening at the lower end, closed with a stopper, and floats in the water contained in the barrel, *h*. The operations are begun by washing in a wooden trough with wooden stamps as many pine cones as may be introduced into the kettle, together with $\frac{1}{2}$ to $\frac{1}{3}$ of their volume of water. The addition of the latter is regulated by the degree of dryness of the cones. In the course of about twelve hours the distillation is completed.—*Indust. Bl.*

PLATINO-POTASSIC CHLORIDE.

By DR. H. PRECHT.

THE author treats, in the first place, of the preparation of platinum chloride from residues. The concentrated alcoholic solutions are reduced, at a boiling temperature, by a mixture of soda solution and glycerin. Platino-potassic chloride is also completely reduced if gradually added to the boiling mixture, and if sufficient sodium carbonate is present. The precipitate of platinum-black is washed by decantation in a porcelain capsule till all sulphuric

* The analyses of Syrian and Trinidad asphaltum and the elementary composition of these asphalts as given above, are taken from Dr. Kayser's pamphlet by the *Correspondenz*, and inserted here as ending to make the article from the *Mittheilungen* clearer.

† Misparrat's "Chemistry," Kerl and Lohmann's edition.

* In the pipettes described by M. Berthelot (*Annales de Chimie et de Physique*, 5th series, vol. x., p. 76), in which the gas can be very easily introduced, taken out, and measured over mercury.

* This research was carried on in M. Berthelot's laboratory at the College de France.