

93½ %	<i>Benzylaniline</i>	+	6½ %	<i>Azobenzene</i> ,	$t = 35^\circ \text{C.}$
88 %	"		12 %	"	$t = 32\frac{1}{2}^\circ \text{C.}$
48,6%	"		51,4%	"	$t = 49^\circ \text{C.}$
23,7%	"		76,3%	"	$t = 61\frac{1}{2}^\circ \text{C.}$

On crystallisation of the two compounds from a joint solution in alcohol + chloroform, small aggregated orange-coloured needles were obtained which were unsuitable for further investigation. But it seems that solid solutions are formed here.

As regards *Azobenzene* and *Stilbene* with which *Dibenzyl* forms solid solutions, I have tried to determine, in mixtures of the two substances, the points of initial and final solidification in the usual manner. It appeared that these two substances whose isomorphotropism is almost indistinguishable from real isomorphism, also agree with real isomorphous substances in this respect that they can form a continuous series of mixed phases from 0 % to 100 %. The lower branch of the continuously-rising melting point curve is situated so close to the higher one that a sharp determination was quite impossible.

The following melting points were found:

*Azobenzene* melts at  $68^\circ \text{C.}$

" + 22,9 % *Stilbene* melts at  $82^\circ.4 \text{C.}$

" + 66,94% " " "  $107^\circ.2 \text{C.}$

*Stilbene* melts at  $120^\circ \text{C.}$

The melting point of *Azobenzene* is therefore raised by addition of *Stilbene*. The lowering of the melting point of *Stilbene* is not proportional to the number of molecules of added *Azobenzene* (incorrect rule of KÜSTER) but takes place more slowly.

The mixed crystals obtained from mixed solutions were homogeneous and of a bright red colour. They crystallise beautifully. The mixture being sublimed the vapour deposits mixed crystals as is also observed by BRUNI.

Finally, we wish to observe that *Hydrazobenzene*, notwithstanding the difference in symmetry, shows in its parameters some degree of analogy with *Azobenzene* if we take  $o = \{211\}$ ,  $\omega = \{421\}$  and  $m = \{210\}$ .

*Azobenzene*:  $a : b : c = 2,1076 : 1 : 1,4220$   $\beta = 76^\circ.32'$ .

*Hydrazobenzene*:  $a : b : c = 1,9574 : 1 : 1,2497$   $\beta = 90^\circ$ .

In the case of *Diphenylhydrazine*, notwithstanding its great similarity to the monoclinic system, there is no question of such a distant analogy.

**Chemistry.** — "*The amides of  $\alpha$  and  $\beta$ -aminopropionic acid.*". By Prof. A. P. N. FRANCHIMONT and Dr. H. FRIEDMANN.

(Communicated in the meeting of October 28, 1905).

Some time ago, I was asked for information as to a substance isolated in 1873 by BAUMSTARK from some urines. He describes it as white prisms some millimetres long and resembling hippuric acid not only in form but also in lustre. It is fairly readily soluble in boiling water, with difficulty in cold water and spirit of wine, insoluble in absolute alcohol and ether, and suffers no decomposition when heated to  $250^\circ$ . It is a neutral substance which, however, yields with acids, hygroscopic compounds difficult to crystallise, and gives a precipitate with mercuric nitrate. The analysis led to the formula  $\text{C}_8\text{H}_8\text{O N}_2$ . By means of nitrous acid he obtained from it a liquid acid and from this he prepared a zinc salt, which in zinc and water content corresponds with the zinc salt of sarcosolactic acid. This zinc salt was very soluble in water and in spirit of wine, and from this he concluded that it really consisted of zinc sarcosylactate. He also showed that under the influence of alkalis, one nitrogen atom is readily converted into ammonia and the other into ethylamine, carbon dioxide being also formed.

From this he concluded that his substance was the amide of  $\alpha$ -aminopropionic acid or, as he called it, the diamide of lactic acid.

BELSTEIN in his text-book, mentions BAUMSTARK's substance as the amide of  $\alpha$ -aminopropionic acid but adds a point of interrogation, and rightly so, for BAUMSTARK has tried to control the conclusion drawn from his analytical research by synthetically preparing the diamides of the lactic acids, or amides of the amino-propionic acids, and comparing them with his substance from the urine; from those experiments he drew the opposite conclusion, and declared the previous idea to be incorrect.

But if we look at the synthetical methods applied by BAUMSTARK, it is at once evident that he could obtain nothing else but mixtures, which he has not separated but seems to have regarded as pure substances whose properties were totally different from that of his substance from urine.

Moreover, many, particularly physical properties such as melting point, solubility, neutrality etc. of the substance from urine, are not those which we might reasonably expect of the amides of the amino-propionic acids.

None of the amides of the aminopropionic acids being known, I

instructed Dr. FRIEDMANN to prepare both by a method leading to pure products, in order to end the present uncertainty.

The  $\alpha$ -aminopropionic acid (commercial alanine) was converted in the usual manner into the hydrochloric methyl ester, which melted at  $158^\circ$ . By the action of silver oxide or aqueous caustic soda, in presence of ether, the *free methyl ester* was prepared, which is very volatile, and under a pressure of 15 m.m. passes over between  $38^\circ$  and  $41^\circ$  as a colourless liquid (spec. gr.  $13,5^\circ = 1,0309$ ), which however, after some days changes into a solid mass (alanine anhydride), presumably owing to the interaction of the two functions — amine and organic ester. A nitrogen determination in the liquid gave figures corresponding with those required by the amino ester  $\text{CH}_3\text{CHNH}_2\text{CO}_2\text{CH}_3$ . The amino ester was mixed with a saturated methylalcoholic ammonia and left to itself for a few days. A distillation at  $35^\circ$  at a pressure of 20 mm. removed the ammonia and alcohol and left as residue a colourless oily liquid of a strongly alkaline reaction which is but little soluble in ether and benzene and solidifies in a dessiccator. After being recrystallised from alcohol, the substance on analysis appeared to be pure. It crystallises in needles, is very soluble in alcohol, very hygroscopic and melts at  $62^\circ$ . On prolonged heating ammonia is set free and alanine anhydride is formed, as was indeed to be expected. The  $\alpha$ -aminopropionic amide  $\text{CH}_3\text{CHNH}_2\text{CO}\cdot\text{NH}_2$  gives also a well-crystallised compound with hydrogen chloride, a fine crystallised orange-red chloroplatinate, which is readily soluble in water, but little so in alcohol, and a bright yellow picrate, little soluble in water, which on being recrystallised from alcohol melts at  $199^\circ$ . Thus we have sufficiently characterized this amide for the present. It seems to be decomposed already at ordinary temperature in an exsiccator.

The  $\beta$ -aminopropionic acid was prepared but with a slight modification, according to HOOGEWERFF and VAN DORP from succinimide<sup>1)</sup>. Like the  $\alpha$ -compound it was converted into the hydrochloric methyl ester, which melts at  $95^\circ$ .

From this was prepared in the manner described above the free  $\beta$ -aminopropionic methyl ester, which under 18 m.m. pressure distills at  $57^\circ$ — $59^\circ$  as a colourless liquid and is pure as follows from analysis. After a few hours it is decomposed with formation of crystals. By direct treatment with methylalcoholic ammonia the amide was at first obtained as an oily liquid, which was purified by repeated

<sup>1)</sup> This was simply prepared like many other amides (when they and their acids can resist a fairly high temperature) by heating the acid in a current of ammonia until no more water is expelled.

solution in methyl alcohol and precipitation with ether, when it gave good analytical results. On being cooled, it became solid, and on inoculation with a trace of the solid material, it yielded beautiful crystals, melting at  $41^\circ$ . The  $\beta$ -aminopropionic amide  $\text{NH}_2\text{CH}_2\text{CH}_2\text{CO}\cdot\text{NH}_2$  is very hygroscopic, very soluble in alcohol, with difficulty in ether, has a strongly alkaline reaction, absorbs carbon dioxide from the atmosphere and yields a well-crystallised hydrochloride.

Both aminopropionic amides are, therefore, now known and not identical with the substance obtained by BAUMSTARK from urine.

**Physics.** — “Remarks concerning the dynamics of the electron.”

By Prof. J. D. VAN DER WAALS JR. (Communicated by Prof. J. D. VAN DER WAALS).

The theory of electrons is usually deduced from the following equations:

$$\text{div } \mathfrak{d} = \mathfrak{q} \quad \dots \dots \dots \text{(I)}$$

$$\text{rot } \mathfrak{h} = \frac{1}{c} (\mathfrak{d} + \mathfrak{q} \mathfrak{v}) \quad \dots \dots \dots \text{(II)}$$

$$\text{rot } \mathfrak{d} = -\frac{1}{c} \mathfrak{h} \quad \dots \dots \dots \text{(III)}$$

$$\text{div } \mathfrak{h} = 0 \quad \dots \dots \dots \text{(IV)}$$

$$\mathfrak{f} = \mathfrak{d} + \frac{1}{c} [\mathfrak{v} \mathfrak{h}] \quad \dots \dots \dots \text{(V)}$$

The units and notations used are those of LORENTZ's article on the “Elektronentheorie” in the “Encyclopädie der Mathematischen Wissenschaften” V 14.

The equations (I)...(IV) determine the field, the motions of the electrons being given. Equation (V) will be independent of the former four, and determine the motion of the electron in the electromagnetic field,  $\mathfrak{q}\mathfrak{f}$  representing the force exercised by the field on the electric charge. The application of equation (V) is however attended by peculiar difficulties. If in mechanics a body is given its mass is also supposed to be known; then if we know the force, the acceleration, and the law according to which it will move may be calculated. Now if in forming  $\mathfrak{f}$  we take into account all the forces also those excited by the electron itself, then the case that we ascribe a “real” or “material” mass to the electron offers no fundamental difficulty. For the case, however, in which the electron has no real mass the equation (V) assumes the form:

$$\text{force} = 0$$