$\mu_0 L/T$, and both are unknown. But nothing is really gained by taking either of these quantities as a 'fourth unit' and treating it either as a fourth dimension additional to those of length, mass and time, or as a quantity of unknown dimensions in length, mass and time.

The first alternative is an additional complication to electromagnetic theory—it does no doubt simplify certain dimensional equations ; the second is secured by the acceptance by the I.E.C. of the statement that 'μ_0 possesses physical dimensions'.

What is necessary to place the M.K.S. system on a secure basis is the realisation of the facts that the two quantities A and μ_0 are essential, and that if the units of the system are to be the practical units of the C.G.S. system, their values (unrationalised) must be 1 and 10^{-7} and (rationalised) 1 and $4\pi \times 10^{-7}$.

It must, of course, be recognised that another solution to the equation $A^2/\mu_0 K_0 = C^2$ is open to us. We may, with Gauss, put $A = C$ and then $\mu_0 K_0$ becomes a numeric.

Adolf von Baeyer, 1835-1917

By Prof. J. R. Partington, M.B.E.

TWO of the outstanding organic chemists of the later nineteenth and early twentieth centuries were Adolf von Baeyer and his pupil Emil Fischer. As the late Prof. W. H. Perkin said, "their influence has been profound, mainly no doubt because of the immense amount of work of fundamental importance which they have left behind, but to a scarcely less degree by reason of their influence as teachers". The discoveries of Baeyer have also had a most important bearing on chemical industry, although he himself was little interested in their commercial exploitation. The side of theoretical organic chemistry which interested him most was the structural aspect, and in this his views, even in his early publications, were remarkably accurate. He modified in many ways the picture as left by Kekulé, and in some parts modern developments have merely filled in the details.
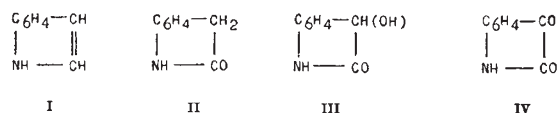
Adolf von Baeyer was born in Berlin on October 31, 1835. His chemical training began, like that of so many others eminent in this science, with Bunsen at Heidelberg. There he worked on cacodyl compounds, already made important in the early history of organic chemistry by the investigations of Bunsen. The latter had little interest in the development of organic chemistry at that time, and Baeyer, who wished to take up this branch of the science, spent two years in a private laboratory of Kekulé at Heidelberg. In 1858 he followed Kekule to Ghent and began work on derivatives of uric acid. His interest in this was aroused in a curious way. During his journey from Heidelberg he became acquainted with a former pupil of Liebig, who gave him a box of specimens of uric acid derivatives. The further investigation of this class of bodies, carried out by Baeyer and his pupil Emil Fischer, may there-fore be said to go back directly to the early work of Liebig at Giessen.
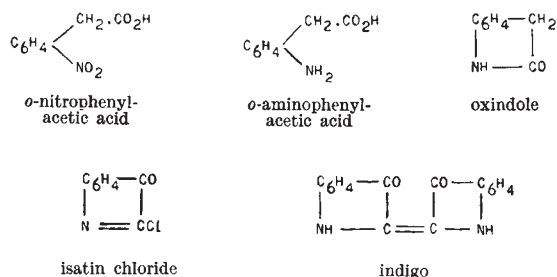
In 1860 Baeyer returned to Berlin as a teacher of organic chemistry in a small technical school. In this poorly paid and modest position he remained for twelve years, during which period he had in his laboratory such men as Graebe, Lieber-mann and Victor Meyer. The work on uric acid derivatives was continued, and in this period Baeyer also put forward the suggestion (in 1870) that the formation of sugar in plants is due to the reduction of carbonic acid, $HO.CO.OH$, in the green leaves and under the influence of light, to formaldehyde, $H.COH$, which then undergoes poly-merisation to grape sugar, $C_6H_{12}O_6$. The study of a very important class of reactions called con-densations began in 1866 with an investigation of the action of acids on acetone, and was developed in various directions, including the condensation of hydrocarbons with phenols and aldehydes. One outcome of this work was the use of phthalic anhydride, which led to the discovery of the phthaleins, many of which are dyestuffs, such as fluorescein, eosin and the rhodamines.

After a period from 1870 until 1875 at Strass-burg, where Emil Fischer was his pupil, Baeyer succeeded Liebig at Munich. For more than twenty years, Liebig's activities at Munich had been con-fined to lecturing and studying the applications of chemistry to agriculture and medicine. There was no laboratory, and Baeyer's first task was to plan large new laboratories which were completed in 1877. In these he continued the investigation of indigo which he had begun in 1865, preparing several derivatives. He found that isatin (IV), a red substance discovered by Laurent in 1840 and produced by oxidising indigo with nitric acid, on reduction yields first dioxindole (III) and then

oxindole (II), which on distillation with zinc dust is reduced to the parent substance, indole (I) :

$$\underset{I}{\begin{array}{c} C_6H_4{-}CH \\ | \quad\;\; || \\ NH{-\!-}CH \end{array}} \qquad \underset{II}{\begin{array}{c} C_6H_4{-}CH_2 \\ | \qquad\; | \\ NH{-\!-}CO \end{array}} \qquad \underset{III}{\begin{array}{c} C_6H_4{-}CH(OH) \\ | \qquad\quad\; | \\ NH{-\!-}CO \end{array}} \qquad \underset{IV}{\begin{array}{c} C_6H_4{-}CO \\ | \qquad\; | \\ NH{-\!-}CO \end{array}}$$
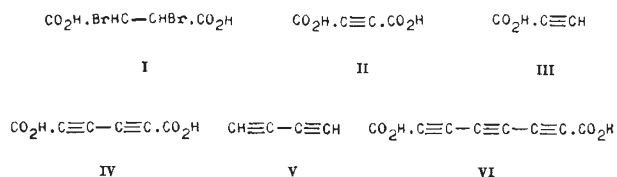
In 1870 Baeyer and Emmerling had found that isatin chloride when heated with phosphorus and hydriodic acid yields indigo, and thus when isatin was synthesised from o-nitrophenylacetic acid in 1870, this was also a synthesis of indigo :

$$\underset{\substack{o\text{-nitrophenyl-}\\ \text{acetic acid}}}{C_6H_4\!\!\begin{array}{c} \nearrow CH_2.CO_2H \\ \searrow NO_2 \end{array}} \qquad \underset{\substack{o\text{-aminophenyl-}\\ \text{acetic acid}}}{C_6H_4\!\!\begin{array}{c} \nearrow CH_2.CO_2H \\ \searrow NH_2 \end{array}} \qquad \underset{\text{oxindole}}{\begin{array}{c} C_6H_4{-}CH_2 \\ | \qquad\; | \\ NH{-\!-}CO \end{array}}$$

$$\underset{\text{isatin chloride}}{\begin{array}{c} C_6H_4{-}CO \\ | \qquad | \\ N{=\!=\!=}CCl \end{array}} \qquad\qquad \underset{\text{indigo}}{\begin{array}{c} C_6H_4{-}CO \quad CO{-}C_6H_4 \\ | \qquad\; | \qquad\; | \qquad\; | \\ NH{-\!-}C{=\!=}C{-}NH \end{array}}$$

Several other methods of synthesising indigo were worked out in the period until 1885, and naturally the German dyestuff firms became interested in the matter. They spent great sums of money on research, but all the processes tried at first proved too expensive, and since Baeyer declined to take an active part in helping to solve the commercial difficulties, some ill-feeling developed on the side of the firms, which led Baeyer to terminate his researches on indigo altogether in 1885.
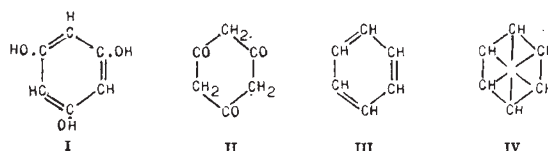
Baeyer then turned to the investigation of a series of interesting but dangerous compounds, the polyacetylenes. From dibromosuccinic acid (I) he obtained acetylene carboxylic acid (II), from which by removal of carbon dioxide he prepared propargylic acid (III). From this the compounds diacetylene carboxylic acid (IV), diacetylene (V) and finally tetracetylene dicarboxylic acid (VI) were obtained. The latter was very explosive.

$$\underset{I}{CO_2H.BrHC{-}CHBr.CO_2H} \qquad \underset{II}{CO_2H.C{\equiv}C.CO_2H} \qquad \underset{III}{CO_2H.C{\equiv}CH}$$

$$\underset{IV}{CO_2H.C{\equiv}C{-}C{\equiv}C.CO_2H} \qquad \underset{V}{CH{\equiv}C{-}C{\equiv}CH} \qquad \underset{VI}{CO_2H.C{\equiv}C{-}C{\equiv}C{-}C{\equiv}C.CO_2H}$$

The properties of these compounds led Baeyer to consider the nature of the triple bond and the stability of rings of carbon atoms, the result being announced in the 'strain theory', in which stability is related to the strain to which the valencies of carbon atoms, normally directed from the centre of the tetrahedron model towards the corners, must be subjected in the formation of closed rings. Although this theory has been to some extent modified by later work, the idea of a resistance to bending exhibited by carbon valencies has been fully substantiated.

In the period between 1884 and 1893 Baeyer published a mass of important work of very varied kind, including the proof that phloroglucinol can function either as trihydroxybenzene (I) or triketohexamethylene (II), a case of what was called tautomeric change, many examples of which Baeyer brought to light.

$$\underset{I}{\begin{array}{c} H \\ HO.C \\ \diagup \;\;\; \diagdown \\ HC \qquad C.OH \\ | \qquad\qquad | \\ HC \qquad CH \\ \diagdown \;\;\; \diagup \\ C \\ OH \end{array}} \qquad \underset{II}{\begin{array}{c} CH_2. \\ \diagup \;\;\; \diagdown \\ CO \qquad CO \\ | \qquad\qquad | \\ CH_2 \qquad CH_2 \\ \diagdown \;\;\; \diagup \\ CO \end{array}} \qquad \underset{III}{\begin{array}{c} CH \\ \diagup \;\;\; \diagdown \\ CH \qquad CH \\ | \qquad\qquad | \\ CH \qquad CH \\ \diagdown \;\;\; \diagup \\ CH \end{array}} \qquad \underset{IV}{\begin{array}{c} CH \\ \diagup | \diagdown \\ CH \;|\; CH \\ | \;\diagdown|\diagup\; | \\ CH \;\diagup|\diagdown\; CH \\ \diagdown | \diagup \\ CH \end{array}}$$

He also worked on partially reduced benzene rings, and made out the profound change in 'aromatic' properties which occurs when a ring is saturated with hydrogen atoms. This work led him to abandon the Kekule formula for benzene (III) and to adopt the centric formula (IV), in which six valencies of the carbon atoms in the ring, instead of being linked in three double bonds, appear as six valencies directed towards the centre of the hexagon. This formula had been proposed by H. E. Armstrong.

Baeyer's work on the terpenes from 1893 until 1899 was important, although the theory was fully clarified only by Wagner and later workers. An oxidising agent used in this work was Caro's acid, which Baeyer and Villiger in 1900 showed was permonosulphuric acid, $HO.O.SO_2.OH$. This led to the study of organic peroxides, such as the benzoyl compound, $C_6H_5.CO.O.OH$, and the two ethyl compounds $C_2H_5.O.OH$ (unstable) and $C_2H_5.O.O.C_2H_5$ (stable), the second of which, on reduction, yielded two molecules of alcohol, hence pointing to the formula $HO.OH$ for hydrogen peroxide.

At the age of sixty-six years, in collaboration with Villiger, Baeyer published a long and important series of researches on oxonium compounds, having become convinced of the truth of Collie and Tickle's interpretation of the salts of dimethylpyrone as containing basic oxygen, a view which he at first opposed. His last research, published in 1915, two years before his death, was on the pyrones and contains the first description of the oxonium colouring matters, which have such an important relation to natural pigments.

Baeyer's work covers a wide range, and it is practically all of fundamental importance.