On anhydrous nitric acid

M. Deville

To cite this article: M. Deville (1849) On anhydrous nitric acid, Philosophical Magazine Series 3, 34:229, 314-316, DOI: [10.1080/14786444908646236](https://doi.org/10.1080/14786444908646236)

To link to this article: <http://dx.doi.org/10.1080/14786444908646236>

Published online: 30 Apr 2009.

Submit your article to this journal [↗](#)

View related articles [↗](#)

uniform velocity. This cone may always be determined. For the circular sections of the invariable cone coincide with the circular sections of the ellipsoid of moments; whence the cyclic axes of the ellipsoid, or the diameters perpendicular to the planes of these sections, will be the focal lines of the supplemental cone; and as the invariable plane is always a tangent plane to this cone, we have sufficient elements given to determine it.

From these considerations it appears that we may dispense altogether with the ellipsoid of moments, and say that if two right lines be drawn through the fixed point of the body in the plane of the greatest and least moments of inertia, making angles with the axis of greatest moment, the cosines of which shall be equal to the square root of the expression

$$\frac{L(M-N)}{M(L-N)},$$

(L, M, N being the symmetrical moments of inertia round the principal axes) and a cone be conceived having those lines as focals, and touching moreover the invariable plane, the motion of the body will consist in the rotation of this cone on the invariable plane with a variable velocity, while the plane revolves round its own axis with an uniform velocity.

Although it is very satisfactory, the author remarks, in this way to be enabled to place before our eyes, so to speak, the actual motion of the revolving body, yet it is not on such grounds that the paper is presented to this Society. It is as a method of investigation that it must rest its claims to the notice of mathematicians; as a means of giving simple and elegant interpretations of those definite integrals on the evaluation of which the dynamic state of a body at any epoch can alone be ascertained.

In these applications of the theory of elliptic functions, the author has been led to the remarkable theorem, that the length of the spiral, between two of its successive apsides, described in absolute space on the surface of a fixed concentric sphere, by the instantaneous axis of rotation, is equal to a quadrant of the spherical ellipse described on an equal sphere moving with the body, by the same instantaneous axis of rotation.

The last section of the paper is devoted to the discussion of that particular case in which the axis of the invariable plane is equal to the mean semiaxis of the ellipsoid of moments.

XLV. Intelligence and Miscellaneous Articles.

ON ANHYDROUS NITRIC ACID. BY M. DEVILLE.

M. DUMAS presented to the Academy in the name of M. Deville, Professor at the Faculty of Sciences of Besançon, the first results of his researches on the action of chlorine on the anhydrous salts which oxide of silver forms both with organic and inorganic acids.

By treating nitrate of silver with perfectly dry chlorine, M. Deville has succeeded in isolating anhydrous nitric acid, the existence of which was demonstrated by numerous analyses. This beautiful substance is obtained in colourless crystals, which are perfectly brilliant and limpid, and may be procured of considerable size; when they are slowly deposited in a current of gas rendered very cold, their edges are a centimetre in length. These crystals are prisms of six faces, which appear to be derived from a right prism with a rhombic base. They melt at a temperature not much exceeding $85^{\circ}.5$ F.; their boiling-point is about 113° ; at 50° the tension of this substance is very considerable. In contact with water it becomes very hot, and dissolves in it without imparting colour, and without disengaging any gas; it then produces with barytes the nitrate of that base. When heated its decomposition appears to commence nearly at its boiling-point; this circumstance is an obstacle to the determination of the density of its vapour by the process of M. Dumas.

The process by which M. Deville obtained anhydrous nitric acid is very simple; but the readiness with which it penetrates tubes of caoutchouc renders it necessary to unite all the pieces of the apparatus by melting them. The following is the process:—the author employs a U-shaped tube capable of containing 500 grs. of nitrate of silver, dried in the apparatus at 356° F. in a current of dry carbonic acid gas. Another very large U-tube is connected with this, and to its lower part is attached a small spherical reservoir; it is in this reservoir that a liquid is deposited which always forms during the operation, and which is excessively volatile (nitrous acid?). The tube containing the nitrate of silver is immersed in water covered with a thin stratum of oil, and heated by means of a spirit-lamp communicating with a reservoir at a constant level. The chlorine issues from a glass gasometer, and its displacement is effected by a slow and constant flow of concentrated sulphuric acid. The chlorine must afterwards pass over chloride of lime, and then over pumicestone moistened with sulphuric acid. At common temperatures no effect appears to be produced. The nitrate of silver must be heated to 203° F., the temperature being then quickly reduced to 136° or 154° , but not lower. At the commencement, hyponitrous acid, distinguishable by its colour and ready condensation, is produced; and when the temperature has reached its lowest point, the production of crystals begins, and they soon choke the receiver cooled to 6° below zero; they are always deposited upon that part of the receiver which is not immersed in the freezing mixture, and M. Deville states that ice alone is sufficient to occasion their formation.

The gases are coloured, and the small sphere of the cooled tube contains a small quantity of liquid, which must be taken from the apparatus before the nitric acid is removed to another vessel; this latter operation is readily effected by replacing the current of chlorine by one of carbonic acid. The condenser is then to be no longer cooled, and the vessel for receiving the crystals is to be immersed in a freezing mixture; this is fastened to the producing apparatus by means of a caoutchouc tube furnished with amianthus. The chlo-

rine should pass very slowly, at the rate of about three or four litres in twenty-four hours. All the gas however is not absorbed by the nitrate of silver. Oxygen is evolved, the volume of which appears to be equal to that of the chlorine employed. An apparatus thus constructed operates day and night without watching, care being however taken to renew the sulphuric acid which displaces the chlorine, the spirit of the lamp, and the ingredients of the freezing mixture.

The author states that he shall forward hereafter a more complete memoir, in which he will describe the chemical properties of the anhydrous nitric acid, and detail the results of his researches on the action of chlorine and hypochlorous acid on the salts of silver.—*L'Institut*, Fevrier 21, 1849.

ON A SERIES OF ORGANIC ALKALIES HOMOLOGOUS WITH
AMMONIA. BY A. WURTZ.

The history of the ammoniacal compounds, so complete and so important in a theoretical point of view, forms in some measure a transition between inorganic and organic chemistry. Ammonia should decidedly be regarded as the most simple and the most powerful of the organic bases; and it would be for all chemists the type of that numerous class of bodies, did it not differ in one undoubtedly important character, but to which an exaggerated value has been attributed. Ammonia contains no carbon. This difference however of composition does not suffice, in my opinion, to separate ammonia from the organic bases; I have succeeded, in fact, in converting this alkali into a true organic compound, by adding to it the elements of the hydrocarbon C^2H^2 or C^4H^4 , without depriving it of its characters of a powerful base, or of its most striking properties, for instance its odour. By adding to the elements of ammonia, NH^3 , the elements of 1 equiv. of methylene, C^2H^2 , the compound C^2H^5N , which may be called methylic ammonia, is obtained. By adding to ammonia the elements of ethylene, C^4H^4 , ethylic ammonia, C^4H^7N , is obtained.

The compounds C^2H^5N and C^4H^7N may be viewed as methylic æther, C^2H^5O , and ordinary æther, C^4H^5O , in which the equivalent of oxygen is replaced by 1 equiv. of amidogen, NH^2 ; or as ammonia in which 1 equiv. hydrogen is replaced by methylum, C^2H^3 , or ethylum, C^4H^5 . The following formulæ will exhibit the relations which exist between these substances and ammonia:—

NH^3 , ammonia.	NH^2 , H, <i>hydramide</i> .
C^2H^5N , methylic ammonia.	NH^2 , C^2H^3 , <i>methylamide</i> .
C^4H^7N , ethylic ammonia.	NH^2 , C^4H^5 , <i>ethylamide</i> .

I shall employ in preference the names methylamide and ethylamide to designate these new bases.

In the present communication I shall restrict myself merely to communicating the circumstances under which these substances are produced, and to communicating the results of some analyses which