

which numbers give the vapour-density 2.235, whilst the theoretical vapour-density of chloride of ethyl is 2.233.

The boiling-point of the residue left after the first distillation rose quickly up to 60° C., whilst nearly the whole distilled over between this temperature and 70° C. By a few more fractional distillations of this latter portion, monochlorinated chloride of ethyl, $C_2H_4Cl_2$, boiling between 62° and 65° C., was isolated.

0.1270 grm. of this compound gave 0.3530 grm. of chloride of silver and 0.0095 grm. of metallic silver, which corresponds to 71.43 per cent. of chlorine, whilst the formula requires 71.71 per cent.

Eight litres of methyl yielded about 8 grammes of the mixed chlorides, or only about one-third of the theoretical quantity of chloride of ethyl which should have been obtained. This is easily explained by the volatilization of the liquid, and its solution in large quantities of water, as well as by the formation of higher substitution-products, in consequence of which a considerable quantity of methyl is left uncombined.

From these results it appears that the lowest term of the series of alcohol radicals behaves with chlorine exactly in the same manner as I have shown in the paper above referred to is the case with its homologues ethyl-amy, C_7H_{16} (which gives chloride of heptyl, $C_7H_{15}Cl$), and amyl, $C_{10}H_{22}$ (from which chloride of decetyl, $C_{10}H_{21}Cl$, is obtained). If an excess of chlorine is avoided, the principal products consist of the chlorides of monatomic radicals containing the same number of atoms of carbon as the original hydrocarbon contained, whilst at the same time chlorine substitution-products of these chlorides are formed in smaller quantities.

As there is no reason why those terms of the series which are placed between C_2H_6 , C_7H_{16} , $C_{10}H_{22}$ should show a different deportment, it becomes obvious that, beginning with marsh-gas, CH_4 , the lowest term in the series C_nH_{2n+2} , the most simple of all hydrocarbons, and one which can easily be obtained from its elements, we are now not only in a position to prepare all the members of this series, but likewise to build up by simple synthesis the series of mono-, di-, and polyatomic alcohols, acids, compound ammonias, ethers, &c. &c. of which each of the marsh-gas hydrocarbons forms the starting-point.

III. "On the Calculus of Symbols (Fifth Memoir), with Applications to Linear Partial Differential Equations, and the Calculus of Functions." By W. H. L. RUSSELL, Esq., A.B. Communicated by Professor STOKES, Sec. R.S. Received April 7, 1864.

In applying the calculus of symbols to partial differential equations, we find an extensive class with coefficients involving the independent variables which may in fact, like differential equations with constant coefficients, be

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solved by the rules which apply to ordinary algebraical equations ; for there are certain functions of the symbols of partial differentiation which combine with certain functions of the independent variables according to the laws of combination of common algebraical quantities. In the first part of this memoir I have investigated the nature of these symbols, and applied them to the solution of partial differential equations. In the second part I have applied the calculus of symbols to the solution of functional equations. For this purpose I have worked out some cases of symbolical division on a modified type, so that the symbols may embrace a greater range. I have then shown how certain functional equations may be expressed in a symbolical form, and have solved them by methods analogous to those already explained.

The Society then adjourned to Thursday, May 12th.

May 12, 1864.

Major-General SABINE, President, in the Chair.

In accordance with the Statutes, the names of the Candidates recommended by the Council for election into the Society were read, as follows :—

Sir Henry Barkly, K.C.B.
William Brinton, M.D.
T. Spencer Cobbold, M.D.
Alexander John Ellis, Esq.
John Evans, Esq.
William Henry Flower, Esq.
Thomas Grubb, Esq.
Sir J. Charles Dalrymple Hay, Bart.

William Jenner, M.D.
Sir Charles Locock, Bart., M.D.
William Sanders, Esq.
Col. William James Smythe, R.A.
Lieut.-Col. Alexander Strange.
Robert Warington, Esq.
Nicholas Wood, Esq.

The following communications were read :—

- I. "Second Part of the Supplement to the two Papers on Mortality published in the Philosophical Transactions in 1820 and 1825."
By BENJAMIN GOMPERTZ, F.R.S. Received March 30, 1864.

(Abstract.)

The objects of this paper are various ; but the subject appears to the author more especially important in consequence of the state of competition among assurance establishments, which he holds to be injurious to the interest of those valuable establishments, and to those of the assuring population.

The author's purpose in this paper is greatly to extend the modes of calculating valuations, and to improve the methods of calculation hitherto used by actuaries, which are in many cases very laborious, and in some almost impracticable. This part commences with observations on the inge-