tical Journal. Here the symbol D of Mr. Boole is replaced by the general symbol ϖ, and moreover the first member of each equation contains two arbitrary functions of ϖ; and by means of another extension, this example gives rise to a whole series of equations constituting a class. The reduction is effected partly by the first general theorem in the calculus of operations, and partly by other means. It must be observed that each of the classes is totally distinct from the others, and its mode of treatment also distinct; also each of the general examples in the series contains two arbitrary functions of the independent variable, and will therefore give the solutions of a large number of particular equations, but for the reason before stated particular examples are not given.

Here likewise, by the interchange of the symbols D and x, another series of equations with their solutions or reductions is obtained, and also another general theorem by which they may be transformed and reduced. But the solutions of the examples of the one series may be deduced from those of the other by the interchange of symbols. It is not a little remarkable that this interchange of symbols in all these cases should be found possible, it will however be found possible in another case to be hereafter described.

The last class of equations discussed in this paper is transformed by means of a general theorem of a very different kind from any of those which have been employed in reducing and integrating any of the previous classes. By means of this transformation, the symbol ϖ, of which the first member of these equations is a function, is placed in a position to operate upon the whole of that member, a certain equation of condition among the coefficients being previously admitted. Hence by operating upon both members with the inverse of this symbol, the equation is once integrated, and, if it be of the second order only, completely solved.

Here too the interchange of symbols may be made both in the equation and its solution, and the solution so changed will be the solution of the equation changed in like manner. The general symbolical theorems, which here consist of a series of terms, may be derived the one from the other in the same way, and by changing the signs of the alternate terms.

Reductions of the arbitrary functions of D, similar to those before made, are made here also; and by particularizing some of the functions so reduced for the sake of simplification, several very singular resulting equations are obtained. If in these we assign to the remaining arbitrary functions, particular forms, and introduce as many arbitrary constants as we can, we may find particular examples which may be of great use in the integration of equations with coefficients containing only integer functions of x.

By a very obvious substitution an arbitrary function of x may be introduced into any of this kind of equations, and also another function of D, and the last often with great advantage.

2. "On the Oils produced by the action of Sulphuric Acid upon various classes of Vegetables." By John Stenhouse, Esq., F.R.S.

Nearly thirty years ago Döbereiner observed, when preparing formic acid by distilling a mixture of starch, peroxide of manganese and sulphuric acid, that the liquid which passed into the receiver contained a small quantity of oil which rendered it turbid. To this oil Döbereiner gave the fanciful name of "artificial oil of ants," though the very limited quantity in which he was able to procure it prevented him from determining almost any of its properties.

The author's attention was first directed to the subject in 1840, when he found that the oxide of manganese was unnecessary, and that the oil could be readily prepared by operating on most vegetable substances with either sulphuric or muriatic acid. The oil, on analysis, was found to have the formula $C_{15}\ H_6\ O_6$, and to contain oxygen and hydrogen in the proportions to form water, while all other oils and fats contain an excess of hydrogen.

The late Dr. Fownes took up the subject in 1845, and made the interesting discovery, that when the oil which he called furfurol is heated with ammonia, a crystalline amide is formed. When this amide is boiled with caustic lyes, it is changed into the crystallizable base furfurine. The paper then describes the best mode of preparing furfurol, and also the method of purifying it from an oil with which crude furfurol is always accompanied, and to which the name of meta-furfurol has been given. Meta-furfurol is the cause of the bright red coloration which impure furfurol instantly produces when it is treated with muriatic or sulphuric acids in the cold. This portion of the paper concludes with some new observations on furfurol, and an examination of some of the salts of furfurine.

It has been pretty satisfactorily ascertained that the constituent of plants which yields furfurol is the *matière incrustante* of M. Payen, viz. the matter with which the interior of the cells of plants is lined. This is an amorphous granular substance which has been gradually deposited from the sap in its passage through the tissue of the plant. It is most abundant in hard woods, such as oak and teak, especially in the oldest portions which lie nearest the heart of the tree. As the author of the paper was led to conjecture that the *matière incrustante* of the different great classes of vegetables would be found on examination analogous but not identical, he thought it likely that the oils derivable from them would also prove not identical with furfurol, though probably very analogous to it in their nature and properties. The algæ or sea-weeds, whose structure is very different from that of ordinary herbaceous plants, were employed to test the truth of this hypothesis. They yielded an aromatic oil to which the name of fucusol was given. Though essentially different from furfurol, it closely resembles that oil in its properties, being also isomeric with it. Fucusol forms a crystallizable amide with ammonia, called fucus amide, which, when it is boiled with alkaline lyes, is also converted into an organic base—fucusine, which is likewise isomeric with furfurine. Fucusine is a rather difficultly crystallizable base; but some of its salts, especially the nitrate, may be readily procured in large crystals. In solubility and crystalline form they differ from those of the corresponding base.

The paper contains an analysis of these salts.

The mosses and lichens were also found to yield fucusol. The ferns, on the other hand, yield a peculiar oil, which differs both from fucusol and furfurol, possessing properties intermediate between them.

The results of these experiments seem to indicate some curious botanical relations, as it appears highly probable that the *matière incrustante* is the same in all phanerogamous plants as they yield furfurol. On the other hand, the *matière incrustante* in the Algæ, mosses and lichens, as it yields fucusol and not furfurol, though the same in each of these classes, is evidently different from that of phanerogamous plants. The *matière incrustante* of ferns appears however to be dissimilar from either of the others, as it yields an analogous but peculiar oil.

April 25, 1850.

The EARL OF ROSSE, President, in the Chair.

M. Quetelet was admitted into the Society.

The following papers were read:—

1. "On the Temperature of Steam and its corresponding Pressure." By John Curr, Esq. Communicated by J. Scott Russell, Esq., F.R.S.

The author states that it is intended in this paper to propose a simple law to determine the pressure of steam corresponding to any given temperature, *irrespectively of experiment*, taking as the sole datum, that the vaporizing point of water under a given pressure is 100 degrees, that number being taken to correspond with the scale of Celsius; also to construct formulæ in accordance therewith; and afterwards to compare their results with the actual experiments of the Academy of Sciences of Paris. He further states that the rationale of the subsequent formulæ is expressed as follows. Let it be conceived that a *given* quantity of water is vaporized under the condition that the pressure thereon is increased in the same ratio that the volume is increased, or that at intervals of temperature 1, 2, 3, &c. the volume is increased the same or in equal proportions; the temperature of the volume will be increased exactly as the square of the temperature indicated by the thermometer, supposing the instrument to be a true measure of temperature, and as the square of the volume; and the same of the pressure.

Steam being generated from an *indefinite* quantity of water and confined within a limited space, as in the usual boiler, he considers the foregoing case is reversed; for the volume being constant, the action of the fire is entirely exerted in producing increased elastic tension of the vapour; therefore the temperature of the steam at the interval 1 to 2 degrees is increased inversely in the duplicate ratio of the ratio in the case first described; that is, the pressure is increased directly at the square of the square, or fourth power of the