

(2) If the English units be used, the minim and the drachm should not be employed at all. All weights should be expressed either in grains or decimal parts of a grain, or in ounces and fractions of an ounce; all measures in fluid grains, or in fluid ounces and fractions of a fluid ounce.

B. *Formula*.—(3) Formulæ should give the number of parts of the constituents, by weight or measure, to be contained in some definite number of parts, by measure, of the solution. The mixture can then be made up with (a) grammes and cubic centimetres, or (b) grains and fluid grains, or (c) ounces and fluid ounces, according to the unit selected.

(4) The standard temperature for making up solutions should be 15° C. or 62° F. No appreciable error will be introduced by the fact that these two temperatures are not quite identical.

(5) Formulæ should give the quantities of the constituents to be contained in x parts of the finished solution, and not the quantities to be dissolved in x parts of the solvent. When a solid dissolves in a liquid, or when two liquids are mixed, the volume of the solution or mixture is, as a rule, not equal to the sum of the volumes of its constituents. The expansion or contraction varies with the nature of the solids and liquids and the proportions in which they are brought together. In making up a solution, therefore, the constituents should first be dissolved in a quantity of the solvent smaller than the required volume of the finished mixture, and after solution is complete, the liquid, cooled if necessary to the ordinary temperature, is made up to the specified volume by addition of a further quantity of the solvent.

(6) It is very important to specify, in the case of liquids, whether parts by weight or parts by measure are intended. The equivalence between weight and measure only holds good in the case of water and liquids of the same specific gravity: a fluid ounce of ammonia solution or of ether weighs less than an ounce; a fluid ounce of strong sulphuric acid weighs nearly two ounces.

(7) Whenever possible, formulæ should give the quantities of the constituents required to make up 10, 100, or 1000 parts of the solution.

(8) When a mixture (e.g. a developer) is to be prepared just before use from two or more separate solutions, it is desirable that the proportions in which the separate solutions have to be mixed should be as simple as possible—e.g. 1 to 1, 1 to 2, 1 to 3, 1 to 10.

(9) When metric units are employed, the original French spelling, "gramme," should be used in preference to the contracted spelling, "gram," in order to avoid misreading and misprinting as "grain."

SCIENTIFIC SERIALS.

In the *Journal of Botany* for June and July we find contributions to systematic and descriptive botany by Mr. E. G. Baker, on new plants from the Andes, and on the genera and species of Malvæ; by Mr. F. N. Williams, a synopsis of the genus *Tunica* of Caryophyllacæ, and others.—Mr. A. Fryer records what he believes to be an example of hybridity in *Potamogeton*.—Mr. H. T. Soppitt describes a new parasitic fungus, *Puccinia digraphidis*, the teleutospore-form of which occurs on *Phalaris arundinacea*, while the æcidio-form is parasitic on *Convallaria majalis*.

The original papers in the *Nuovo Giornale Botanico Italiano* for July all refer to the geographical distribution of Italian plants, chiefly Hepaticæ and Fungi. Among the papers read at the meetings of the Italian Botanical Society the following are of special interest:—Signor O. Kruch contributes to our knowledge of the foliar fibrovascular bundles of *Isoetes*.—The exhaustive researches of Prof. Arcangeli on the structure of the various organs in the Nymphæacæ are represented by an account of the leaves of *Nymphaea* and *Nuphar*.—Signor U. Martelli gives a very interesting account of the dissociation of a lichen (*Lecanora subfusca*) into its constituent algal and fungal elements, the complement of Stahl and Bonnier's observations on the synthesis of lichens.—Prof. Arcangeli describes the carnivorous habits of an Aroid, *Helicodiceros muscivorus*.

American Journal of Science, July, 1890.—The inconsistencies of utilitarianism as the exclusive theory of organic evolution, by Rev. John T. Gulick. The author criticizes

various conclusions arrived at by Mr. Wallace in his volume on "Darwinism."—The southern extension of the Appomattox formation, by W. J. McGee. In a paper entitled "Three Formations of the Middle Atlantic Slope," published in this *Journal* in 1888, a distinctive late Tertiary formation well displayed on the Appomattox River in Eastern Virginia was defined and named after that river; and its principal characters, distribution, stratigraphical relations, and probable age were recorded. The present number contains the result of an extension of the research into the Carolinas, Georgia, Alabama, and Mississippi.—An experimental proof of Ohm's law, preceded by a short account of the discovery and subsequent verification of the law, by Alfred M. Mayer. The experiment described is very suitable for lecture demonstration, and all details are given. A low-resistance Thomson galvanometer is joined up to a box containing coils of 1, 2, and 3 ohms resistance, and to a coil of wire wound round a disk of wood which slides on an upright magnet 1.5 cm. in diameter. The quick movement of this coil causes the production of a magneto-electric current, and adopting the conception of the lines of magnetic force it may be said that a ring with one coil cuts a certain number of these lines, this cutting of the lines causes the current, and is the electromotive force. A ring with two, three, or four coils cuts two, three, or four times the number of lines, and increases the electromotive force in the same proportion. The resistance in the circuit can also be changed by means of the resistance coils, and hence it can be proved that the current is directly as the electromotive force and inversely as the resistance by observations of the galvanometer deflections.—Microscopic magnification, by W. Le Conte Stevens. If F be the equivalent focal length of the eye-piece of a microscope, f that of the objective, T the tube length, and D the distance of distinct vision, the magnification, M , is expressed by the formula $M = \frac{(D + F)(T - f)}{Ff}$.

—Notes on the minerals occurring near Port Henry, N. Y., by J. F. Kemp.—Occurrence of goniolina in the Comanche series of the Texas Cretaceous, by Robert T. Hill.—A method for the reduction of arsenic acid in analysis, by F. A. Gooch and P. E. Browning.—On the development of the shell in the genus *Trocnoceras*, Hyatt, by Dr. Charles E. Beecher.—Fayalite in the obsidian of Lipari, by Jos. P. Iddings and S. L. Penfield.—On some selenium and tellurium minerals from Honduras, by Edward S. Dana and Horace L. Wells. The locality from which the minerals were obtained is the El Plomo mine, Ojojoma District, Department of Tegucigalpa, Honduras. An analysis of one showed that it contained 29.31 per cent. of selenium and 70.69 per cent. of tellurium, the great proportion of selenium constituting it the nearest approach to native selenium which has yet been found in nature. It is proposed to call this mineral selen-tellurium. Some tellurium-iron minerals are also described.—Some connellite from Cornwall, England, by S. L. Penfield.

American Journal of Mathematics, vol. xii., 4 (Baltimore, July 1890).—This number opens with a short note (pp. 323-336) on confocal bicircular quartics, by Prof. Franklin, and closes with a memoir on the theory of matrices, by H. Taber (pp. 337-396.) The memoir is a full investigation of the subject, touching upon the results already obtained by Cayley ("Theory of Matrices," *Phil. Mag.*, 1858), Hamilton ("Quaternions," 1852), the two Peirces, and Clifford. The writer was not aware of Buchheim's paper, with an identical title, in the London Mathematical Society's Proceedings (vol. xvi.) until after his own paper was written. There is much which is substantially the same in the two memoirs, but Mr. Taber claims to have "treated the whole subject more in detail and more systematically than Mr. Buchheim" (*sic*).

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 15.—M. Hermite in the chair. New studies on the rotation of the sun, by M. H. Faye. An account is given of Dr. Wilsing's observations of faculæ for the purpose of determining the time of rotation, and of the recent work done by M. Dunér, in which Fizeau's method was adopted.—On the photography of the polarization fringes of crystals, by MM. Mascart and Bouasse. A method of obtaining photo-

graphs of these fringes is described.—On the freezing of meat by cold liquids, by M. Th. Schloesing. A new method for freezing and preserving large quantities of meat is described.—The active elasticity of muscle, and the energy used in its creation, in the case of dynamic contraction, by M. A. Chauveau.—On linear differential equations, by M. Cels.—Method of measuring the difference of phase of the rectangular components of a refracted light-ray, by M. Bouasse.—On the measurement of the vapour-tension of solutions, by M. Georges Charpy. The author uses the condensation hygrometer to determine indirectly the tension of the vapour above the solution employed.—On the laws of Berthollet, by M. Albert Colson.—Researches on the double nitrates of rhodium, by M. E. Leidié. Double nitrates of rhodium and potassium, sodium, ammonium, and barium respectively are described, methods of preparation and properties of each salt being given.—On some combinations of camphor with phenols and their derivatives, by M. E. Léger. Many of the compounds obtained yield crystals of definite form and constant composition, and are hence proved to be true compounds.—On mannite hexachlorhydrin, by M. Louis Mourgues. The method of preparation and properties of this body are given; its analysis indicates that it possesses the formula $C_6H_8Cl_6$, Raoult's method gives its molecular weight as 278; the writer is of opinion that its constitution corresponds to $CH_2Cl(CHCl)_4CH_2Cl$.—On some new derivatives of β -pyrazol; a contribution to the study of the nitric ethers, by M. Maquenne.—Researches on the division of the embryonic cellules among the Vertebrata, by M. L. F. Henneguy.—On the colouring reagents of the fundamental substances of membrane, by M. L. Mangin. The author compares the action of colouring matters of membrane with their chemical composition, and establishes the results furnished by the colouring reagents by chemical analyses of the tissues.—On the expansion of silica, by M. H. Le Chatelier. The experiments show that amorphous silica expands very little between $600^\circ C$. and $1000^\circ C$. Quartz expands regularly up to nearly 600° , and then reaches a point where increase of temperature causes contraction. Calcined chalcidony expands slowly up to 200° , then the coefficient of expansion is enormously increased for a time, but finally it returns to the original value. Tridymite behaves much like chalcidony, expanding slowly up to about 120° , when an abrupt change takes place; the slow expansion then returns again, and finally contraction takes place with increase of temperature. Thus the change in the coefficient takes place at a higher temperature in the minerals of high density (quartz, chalcidony) than for those of lower density (tridymite and calcined chalcidony).—Analysis of the menilite of Villejuif, by M. Auguste Terrell.—On the prediction of storms by the simultaneous observation of the barometer and the higher atmospheric currents, by M. G. Guilbert.

AMSTERDAM.

Royal Academy of Sciences, June 28.—Prof. van de Sande Bakhuysen in the chair.—Dr. Beijerinck described experiments relating to the culture of *Zoöchlorella*, *Lichen gonidia*, and other lower Algae in a pure state.—The same speaker treated of the artificial infection of *Vicia Faba* with *Bacillus radicolica*. Twelve pots filled with sterilized river-sand, which was rendered very poor in nitrogen by washing with distilled water, were divided into four sets, each of three. On April 25, a well-sterilized seed of *Vicia Faba* was planted in each pot. The pots were of such a construction that the dust of the air was wholly excluded from the sand, and the watering could also take place under perfect dust-exclusion. The first set was watered with a mixture of 0.1 monopotassium phosphate, 0.03 calcium chlorate, 0.06 magnesium sulphate, pro 1 litre distilled water; the second set with the same mixture; the third set with the same mixture, to which was added 0.2 gr. calcium nitrate; the fourth set with the same mixture, to which was added 0.2 gr. ammonium sulphate. When the plants had developed their second leaf, the three pots of the first set, and one single pot of each of the three latter sets, were infected with a gelatine culture of *Bacillus radicolica* var. *fabae*, cultivated in 1889 from the tubercles of *Vicia Faba*, and since that time kept in successive cultures. The bacteria wherewith the infection took place were mixed with sterilized common water. On June 20 there was found on one old cotyledon a *Penicillium*, and therefore the experiment was not further continued. All the plants were taken from the pots, and their roots well washed and examined; every single one of the six in-

fecting plants bore many tubercles, whilst no single one of the six remaining not infected plants showed the least sign of tubercles. The presence or absence of nitrogen as nitrate or as ammonium is therefore indifferent with regard to the practicability of the infection. By another set of experiments it was shown that gelatine cultures of *Bacillus ornithopi*, cultivated in 1889 from the tubercles of *Ornithopus perpusillus*, had no power to infect *Vicia Faba*. But negative results are not equal to positive in value.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Evolution of Photography: J. Werge (Piper and Carter).—Higher Geometry, W. J. Macdonald (J. Thin).—Zoological Types and Classification: W. E. Fothergill (J. Thin).—Principles of General Organic Chemistry: Prof. E. Hjelt, translated by J. Bishop Tingle (Longmans).—Philosophy of Tumour Disease: C. Pitfield Mitchell (Williams and Norgate).—Diseases of Crops and their Remedies: A. B. Griffiths (G. Bell and Sons).—Principles of Economics, vol. i.: A. Marshall (Macmillan and Co.).—Elementary Text-Book of Heat and Light: R. Wallace Stewart (W. B. Clive and Co.).—Quarterly Review, July (Murray).—The Forum, July (New York).—Electrical Engineer's Pocket-Book: H. R. Kempe (Lockwood).—Monograph of the British Cicadæ, Part III.: G. B. Buckton (Macmillan and Co.).

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