cal species found on the Restigouche River in close proximity to those of a more southern or New England type found along that river and on the upper St. John.

Dr. A. H. MacKay, Superintendent of Education for Nova Scotia, gave the results of a series of phenological observations carried on by the teachers and pupils of the schools in that province, one important object of which is the encouragement and stimulus given to 'nature study.'

The results of a series of interesting experiments, noting the behavior of blind animals, were given by Professor Wesley Mills, of McGill University; and Professor B. J. Harrington, of the same University, read an appreciative sketch of the life and work of the late Dr. Geo. M. Dawson.

The officers of the Royal Society for the current year are:

President, Sir James Grant, Ottawa; *Vice-President*, Lt.-Col. G. T. Dennison, Toronto; *Secretary*, Sir John Bourinot, Ottawa; *Treasurer*, Dr. Jas. Fletcher, Ottawa.

An excursion to Niagara Falls, of which about thirty members of the Society—chiefly scientists—availed themselves, was given by the citizens of Toronto. The party visited the works of the Canadian Power Company, whose guests they were for a day; and also were allowed to inspect the plant of the Niagara Falls Power Company on the American side, a favor which was greatly appreciated.

G. U. Hay.

St. John, N. B.

SECTION OF THE MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES.

By special invitation the annual meeting of the Royal Society of Canada was held at Toronto, in the buildings of the University, on May 26–29. The sessions were largely attended, and the cool weather contributed to the success of the excursion to Niagara Falls (where the members were guests of the Canadian Niagara Power Co.) and of the trip along the lake shore to examine the interglacial deposits east of Scarborough.

The third Section (Mathematical, Physical and Chemical Sciences) met in the large physical lecture room, the President, Professor R. F. Ruttan, M.D., C.M., in the chair. 'Dalton and the Theory of Atoms' formed the subject of the President's address, and the reading of papers was diversified by a debate on the 'Existence of Particles Smaller than Atoms.' Professor Rutherford gave an account of the growth of the electron theory, and showed how the masses and velocities assigned to the hypothetical 'carriers' had been arrived at. Dr. J. C. McLennan exhibited a number of experiments illustrative of the facts on which the theory is based. Professor Lash Miller discussed the advantages and disadvantages of corpuscular theories in general, showing that they were impossible to prove and nearly as impossible to disprove, and Professor Cox spoke of the recent extension of the theory to cosmical phenomena. Professors Goodwin, Baker, Walker and Ruttan also took part in an animated discussion.

At the close of the sessions, Dr. J. C. Glashan, of Ottawa, and Professor H. T. Barnes, of Montreal, were elected members of the Section, and Professor M. Berthelot, of Paris, a corresponding member of the Society.

The following papers were read before Section 3:

MATHEMATICS.

On the Correlation of the Curve of the Second Order and the Sheaf of Rays of the Second Order in Geometry of Position: Professor A. Baker.

Beginning with the curve of the second order, which may be considered to be defined by five points, tangents are constructed at these five points; and viewing the tangents as the basis of a sheaf of rays of the second order, the original five points are shown to be points of contact. Reverting to the original five points, construction for a sixth point is made, and the tangent at that sixth point is obtained; this tangent is shown to belong to the sheaf of rays of the second order furnished by the five original tangents. It was also shown that the curve is uniquely determined whatever two points be selected as radiant points; and an analogous proposition was established with regard to the sheaf of rays.

On the Matrix Analysis of Quantics and Their Concomitants: Dr. J. C. GLASHAN.

A development of the consequences of applying to the operand as well as to the operator the notation of matrices.

Forms for the Abelian Integrals of the Three Kinds: Dr. J. C. FIELDS.

A Theorem Regarding Determinants with Polynomial Elements: Professor W. H. METZLER.

Generalization of a theorem of Muir's (*Messenger of Math.*, No. 153, 1884) omitting the restriction that the number of terms in each element of the determinant must be greater than the number of constituents in a row.

PHYSICS.

On the Use of the Wheatstone Stereoscope in Photographic Surveying: Capt. E. DEVILLE.

Description of an instrument proposed for drawing a topographical plan by mechanical means from a pair of stereoscopic photographs.

The Neutral Axis of Beams Under Transverse Loads: Professor H. T. BOVEY.

Experiments with a new Extensometer. The assumptions of the text-books are verified for a cast-steel beam of square cross section, but not for a T-beam.

Soli-Lunar Time: Mr. G. W. MCCREADY.

The average date of the first full moon in every decade for 4,000 years.

The Potential Difference Required to Produce Discharge in Air and Other Gases: Mr. W. R. CARR.

Experiments carried out under the direction of Dr. J. C. McLennan, with air, hydrogen, carbon dioxide, acetylene, hydrogen sulphide, nitrous oxide, sulphur dioxide and oxygen. The law governing electric discharges between parallel plates, in a uniform field, in any gas, for pressures at and below the critical pressures, is that which Paschen found to hold with spherical electrodes for high pressures, viz., that with a given spark potential, the pressures at which discharge occurs is inversely proportional to the distance between the electrodes.

The values of the spark potentials are not influenced by the material or size of the electrodes; and the minimum spark potential is independent of the pressure and of the distance between the electrodes, always provided that the discharge is compelled to pass in a uniform field.

Penetrating Rays from Radium: Professor E. RUTHERFORD.

Experiments showing the passage of the rays through from eight to ten inches of iron. The ionization produced by the rays after emerging from the iron shows that they must be regarded as consisting of negatively charged particles. Photographic methods are being applied to determine the magnetic deflection of the rays.

Radio-active Emanations from Thorium and Radium: Professor E. RUTHERFORD.

Résumé of a number of recent experiments by the author.

Excited Radio-activity from the Atmosphere: Mr. S. J. ALLAN.

The amount of the radio-activity is independent of the material of the negatively electrified wire. After exposure, the intensity of the radiation fell to one half in fifty minutes; while that excited by thorium fell to one half in eleven hours.

Radio-activity Induced in Salts by Cathode Rays and by the Discharge Rays from an Electric Spark: Mr. W. R. CARR.

Experiments carried out under the direction of Dr. J. C. McLennan. Radio-activity is excited in certain salts by Röntgen rays, as well as by cathode rays, and by the discharge rays from an electric spark.

Radio-activity Induced in Substances Exposed to the Action of Atmospheric Air: Mr. R. M. STEWART.

Experiments carried out under the direction of Dr. J. C. McLennan. The rate of loss of induced radio-activity depends on the potential at which the wire was exposed, rather than on the time of exposure.

On the Absolute Value of the Mechanical Equivalent of Heat: Professor H. T. BARNES.

The heat required to raise the temperature of one gram of water from 15.5° to 16.5° C. is equal to 4.1832×10^7 ergs. In gravitation units this becomes 426.60 kilogrammeters, or 777.58 foot-pounds.

On the Density of Ice: Professor H. T. BARNES and Mr. H. L. COOKE.

Historical résumé and criticism. New experiments. Probable cause of variation in density. Bibliography.

The Variation in the Density of Ice: Mr. H. L. COOKE.

The variation is ascribed to mechanical strains due to unequal expansion and contraction.

The Fall of Potential Method as Applied to the Measurement of the Resistance of an Electrolyte in Motion: Professor H. T. BARNES and Mr. J. G. W. JOHNSON.

Measurements of the conductivity of solutions of magnesium chloride. During the measurements the solution flowed slowly through the cell; the velocity of flow did not affect the results.

CHEMISTRY.

A Modification of Victor Meyer's Vapor Density Apparatus: Professor B. J. HARRINGTON.

The long stem is bent into a series of loops, and a second opening is provided for introducing the substance into the bulb. The apparatus is compact and convenient.

On the Determination of Moisture in Honey: Mr. F. T. SHUTT.

The honey is dried in a current of air at a constant temperature below 100° C., and the loss determined.

An Improved Method of Producing Concentrated Manure from Human Refuse: Mr. T. MACFARLANE.

Description of an odorless moss-closet. When properly used, the quantity of absorbent is not more than one twentieth of the resulting manure.

Experimental Investigation of the Conditions Determining the Oxidation of Ferrous Chloride: Mr. A. McGILL.

Ferrous chloride can be decomposed by oxygen in such a way as to yield uniformly from 75 to 85 per cent. of its chlorine in available form, and from 10 to 20 per cent. as hydrochloric acid.

Analysis of Anthraxolite from Hudson's Bay: Professor W. H. ELLIS.

A sample brought by Mr. G. R. Mickle from Long Island, Hudson's Bay, contained 0.54 per cent. ash. The dry ash-free mineral gave: carbon, 96.54; hydrogen, 1.33.

Abnormal Results in the Hydrolysis of Amygdaline: Professor J. W. WALKER and Mr. W. S. HUTCHINSON.

Boiled with dilute acids amygdaline is resolved into glucose, hydrocyanic acid and benzaldehyde. Heated with concentrated hydrochloric acid it yields a humus substance and dextro-mandelic acid. Boiled with dilute alkalies it yields ammonia and amygdalinic acid, which on hydrolysis with dilute hydrochloric acid gives inactive mandelic acid.

Oudemann's Law, and the Influence of Dilution on the Molecular Rotation of Mandelic Acid and its Salts: Professor J. W. WALKER.

Strong indications were found that the law was not confirmed in very dilute solutions, where it ought to hold most rigidly.

Specific Heats of Organic Liquids, and Their Heats of Solution in Organic Solvents: Professor J. W. WALKER and Dr. J. HENDERSON.

An electric method is employed for determining the specific heat; a close connection is indicated between the degree of association of a liquid and its heat of solution in an unassociated solvent.

The Specific Heat of Water of Crystallization: Mr. N. N. EVANS.

The solid, finely ground, is suspended in a suitable liquid in the calorimeter, and a measured quantity of heat is introduced electrically. A range of four degrees is sufficient for accurate results.

Researches in Physical Chemistry Carried Out in the University of Toronto During the Past Year. Communicated by Professor W. LASH MILLER.

Under this head the following eight papers were introduced.

Application of Polarimetry to the Determination of Tartaric Acid in Commercial Products: Professor E. KENRICK and Dr. F. B. KENRICK.

The method is based on the addition of ammonium molybdate to the material to be analyzed; it is applicable in the presence of alum, iron, sugar, etc.

The Sulphates of Bismuth: Dr. F. B. ALLAN.

An application of the phase rule. The following salts were identified: $Bi_2O_3.4SO_3$, $Bi_2O_3.2SO_3.2\frac{1}{2}H_2O$, $Bi_2O_3.SO_3$. (*Am. Chem. Jour.*, 27, 284.)

The Influence of Iron Salts on the Rate of Reaction Between Chromic Acid and Iodides: Miss C. C. BENSON.

The rate of liberation of iodine as a function of the concentrations of the reacting substances; and the rate of oxidation of ferrous salt by chromic acid in presence and absence of iodide.

The Reaction Between Stannous Chloride and Potash: Mr. C. M. CARSON.

The results are in conflict with those of Ditte.

The Rate of Oxidation of Iron Salts by Oxygen: Mr. J. W. MCBAIN.

Experiments carried out under the direction of Dr. F. B. Kenrick. (*Jour. Phys. Chem.*, V., 623.)

The Rate of Reaction in Solutions Containing Potassium Chlorate, Potassium Iodide, and Hydrochloric Acid: Mr. W. C. BRAY.

Experiments showing that two reactions of the fourth order occur simultaneously. Schlundt's results are recalculated.

The Rate of the Reaction Between Arsenious Acid and Iodine in Acid Solution; the Rate of the Reverse Reaction; and the Equilibrium Between Them: Mr. J. R. ROEBUCK.

The 'Thiosulphate Method' of Measuring the Rate of Oxidation of Iodides: Mr. J. M. BELL.

The method was introduced by Harcourt, using sodium peroxide as oxidizing agent; it is not applicable when chloric acid, chromic acid, or ferric salts are employed. Schükarew's assumptions (*Zeit. Phys. Chem.*, XXXVIII., 357) are not justifiable.

W. LASH MILLER,
Secretary pro tem.

PROBLEMS IN THE CHEMISTRY AND TOXICOLOGY OF PLANT SUBSTANCES.*

THE organic chemistry of to-day is the chemistry of the approximately 50,000 carbon compounds, enumerated in the recent edition of Beilstein's 'Handbuch der Organischen Chemie.' Most of these compounds are the fruit of research in purely synthetic chemistry, enormously stimulated, as it has been of late, by the growth of new, far-reaching conceptions in physical chemistry, and, especially, by the substantial rewards of the chemical industries which have arisen as a result of these investigations; a considerable number of the compounds enumerated have, however, been isolated from plants. Some of this work of plant investigation has been adequately rewarded, but as a rule it has only awakened a greater esteem for the investigator. The larger returns of synthetic chemistry are still enticing most of our best organic chemists into its fold, but its phenomenal success in producing substances such as urea, sugar and several plant alkaloids and glucosides hitherto known only as the products or educts of life, has stimulated inquiry not only into the chemical nature of cell life, but also into the chemistry of the dead principles that may be isolated from these cells. Mother Nature is, however, a very cunning and crafty chemist, with a keen understanding of all of the requirements of cell growth under astonishingly varied conditions of environment, and especially with an eye for the protection and perpetuation of her multitudinous progeny against the ravages of parasites, or of man and beast, she has built up a very great variety of compounds, the properties and methods of formation of many of which she still holds secret. Many of these compounds, especially those primarily designed for the protection of the plant, react physiologically on diverse forms of animal life, and are, therefore, recognized by the medical fraternity and by chemists as 'active principles.' All which produce disturbances of the normal functions of an animal when introduced into its economy are, according to Hermann's well-known textbook on pharmacology, called poisons.

It is a sad commentary on the present state of our knowledge of plant chemistry that all we know chemically about the active principles of many plants is that the plants themselves are poisonous. Chemistry might be excused for her lack of interest in examining such physiologically-inert bodies as cellulose and chlorophyll, but it would seem that the plant poisons should at once challenge attention simply on account of their great tendency to react chemically, as they do with some one or more of the essential constituents of the animal organism. The dreaded effects upon man of such plants as the 'deadly upas,' the 'deadly manchineel,' or the common 'poison ivy,' deter many chemists from handling them, and, as shown above, there is little inducement financially for one to enter into such investigations, but the chemist's lack of a knowledge of botany is more frequently the controlling factor in this neglect. Many of the most interesting problems of plant poisoning cannot be conceived either by the chemist or by the botanist alone, but one who is

* Address of the retiring president of the Chemical Society of Washington, April 10, 1902.