THE TORONTO TECHNICAL SCHOOL.

Following is an abstract of the address delivered by Mr. John A. Duff, Principal of the Toronto Technical School at the opening of the second term on Oct. 3rd.:—

It has been announced that I am to speak to-night on "The Benefit of Technical Knowledge in Mechanical and Industrial Pursuits. It would probably be inferred that I would endeavor to enumerate the advantages and advocate the claims of Technical Education in general, but I do not think that any one will be disappointed at hearing that such is not my intention, for I feel sure that everyone will be more interested in hearing what facilities for such education are provided by the Toronto Technical School, and by explaining the scope and bearing of the subjects taught I think I can more effectively than in any other way make clear to you the advantages to be derived therefrom.

The history of the Toronto Technical School is brief. In December of last year the City Council passed a by-law, appointing a Board of Management and giving them an appropriation of $6,000 and the free use of St. Lawrence Hall. The Board at once began the work of organization, teachers were appointed, and the courses of study decided upon, and St. Lawrence Hall having been found unsuitable, this building was secured and the necessary alterations made with such expedition, that by the first of February the work of the session was well commenced. The attendance from the first was large, and was well maintained throughout the term, and very satisfactory progress was made.

Such has been the past. There is every reason to hope that the coming year will be still more successful and that the Toronto Technical School will rapidly become a great power for the dissemination of scientific knowledge and habits of correct thought. With additional teaching power we have been able to make the course of study more comprehensive. Trigonometry will be taught twice a week instead of once, which was all the time we were able to devote to it last year, and, if necessary, the classes in Arithmetic and Measuration will be sub-divided. Arrangements have been made for three classes per week in Chemistry and Physics, which will enable us to provide a tolerably complete course on electricity—that mysterious power which seems destined to usher in a new era of civilization. There is thus provided for the current year the following distinct courses of study. Mathematics, including Arithmetic, Mensuration, Algebra, Euclid, Trigonometry; Practical Geometry, Descriptive Geometry, Mechanical and Architectural Drawing; Mechanics, including Statics, Kinematics and Dynamics; Chemistry and Physics, including Hydrostatics, Heat, Sound, Light and Electricity.

Each student is allowed to select his own studies subject only to the requirements of the time table. With only ten teaching hours in the week it is impossible to make provision for all the classes without having two different subjects occur at the same time, and thus to some exent the freedom of choice in the selection of studies is curtailed. The time table has, however been carefully arranged, so that the least possible inconvenience will be felt from this source For example, if a student has so far forgotten his Arithmetic that it would be necessary for him to take lessons in that subject, he would not be able, until he has become familiar with Arithmetical operations, to derive much benefit from the lessons in Mechanics. We have therefore put Arithmetic and Mechanics down for the same hour, and the students who find it necessary to review their Arithmetic, and who wish to study Mechanics, will find it not a hardship but very much to their advantage, to take Arithmetic during the present session and defer the Mechanics for another year. As the success of the student and therefore of the school depends largely on the proper selection of the course of study, let me briefly describe the different subjects taught, and incidentally mention some of the advantages derived from each.

Let us begin with Mathematics, the interpreter and herald of scientific knowledge, and without which little real progress can be made. Mathematics is one of the most potent instruments of scientific investigation, besides being the only foundation upon which exact scientific knowledge can be built. In Science and Engineering, theories are of little value unless they are exact and definite, and we cannot have this exactness without Mathematics. A knowledge of Mathematics is not necessary in order to understand the general laws of nature, but it *is* necessary in order to state those laws with exactness or make any practical application of them Anyone can understand that water will flow through pipes but no one can calculate the quantity which will flow through a given pipe in a given time without a knowledge of Mathematics. I do not mean to say that Mathematics must be pursued to its highest developments but it *is* necessary to have at least a good working knowledge of Arithmetic, Algebra and Geometry.

The course on Arithmetic—the corner stone of Mathematics—will comprise instruction in numeration and notation, the operations of addition, subtraction, multiplication and division, the use of fractions and decimals, ratio and proportion, the method of extracting square root and the theory of logarithms—in short a complete course in Pure Arithmetic, including all the arithmetical operations which are used in the other branches of Mathematics and Science, but excluding Commercial Arithmetic, which is the application of the forgoing rules to the computation of interest, discount, stocks, annuities, &c., and which finds its proper place in the curriculum of a Business College.

Along with Arithmetic are taught the rules of Mensuration, by means of which the areas of surfaces and the volumes of solids may be calculated and compared. A knowledge of these rules may be required by any man at any time or place.

In Algebra the work will be the same as that which is ordinarily taught in the High Schools of Ontario, which is all that is usually required in pure or applied science. I will not occupy your time with a more particular ennumeration, but I wish to impress upon all intending students the vital importance of Algebra in chemistry and physics. In these sciences formulae occur which can only be properly expressed by algebraic symbols, and the only practical method of solving problems or determining an unknown quantity is by means of algebraic equations But if Algebra is of so great importance in Chemistry and Physics, it is absolutely indispensable to the proper study of Natural Philosophy or Mechanics. Very few calculations involving force or motion can be made without its aid, and without Algebra a knowledge of Mechanics must always prove to be incomplete and unproductive What has been said of Algebra is true to almost as great a degree of Trigonometry and Euclid's elements of Geometry. Euclid has the further advantage of being one of the most perfect systems of logic that has ever been constructed and no one can master Euclid without becoming a logician.

Let me here remark that the aim of higher education ought not to be so much to fill the student with dry facts, as to teach him how to use what knowledge he already possesses—in other words to teach him how to think properly, and to act accordingly. And one of the greatest works that a Technical School can do is to teach mechanics the *art of thinking*. To do this there is no study so efficacious as Mathematics, for there is no other branch of knowledge so exact and definite, and there is no other in which the reason alone is employed.

In Chemistry, it is proposed to teach the mode of occurrence, the nature, and methods of preparation of the different elements and compounds which are of importance in everyday life, special attention being given to those substances and processes which are of technical value, such as electrolysis, coal, and the manufacture of coal gas, iron and steel, mortars and cements.

Lying in the border land between Chemistry and Physics, is the study of the constitution and properties of matter.—a few lectures will be devoted to his very interesting subject.

Under Hydrostatics will be taught the general character and properties of liquids, and the theory of the common hydrostatic and hydraulic instruments, such as the hydrostatic balance, hydraulic press, spirit level, hydrometers, electrometers, etc. Along with hydrostatics, though scarcely belonging to it, come the physical properties of gases and the atmosphere, the theory of the barometers, pumps, balloons and siphons.

The course on Heat will embrace the nature, sources, transmission and general effects of heat, the theory and construction of thermometers, the determination of the melting and boiling points, freezing mixtures, distillation and evaporation, and the theory of steam engines.

Lectures will be given on the elementary theory of Sound and Light in, which the theory and construction of optical and musical instruments will be described.

Electricity will be taught in two divisions. The relation of Chemistry to electricity, and the theory and construction of electric batteries, will be described in connection with the course on Chemistry. In connection with Physics, there will be a course on magnetism and current electricity, the theory and construction of the dynamo, telephone and telegraph, and the applications of electricity in daily life.

In Chemistry and Physics the lectures will be illustrated by experiment as far as our apparatus will permit. We hope that very soon, though perhaps not during the present year, there will be a laboratory in connection with the school, in which practical work in Chemistry and Physics may be done by advanced students. The advantages to be derived therefrom must be apparent to all, and let us therefore hope that it will soon be an accomplished fact. There will be a course on Practical Geometry, which is intended to give facility in the use of drawing instruments and the construction of geometrical figures. It will be found very useful as an introduction to the course on Descriptive Geometry or the theory of projection. That on Descriptive Geometry will comprise the representation of objects by means of a plan and elevation, and problems leading up to and solved thereby, such as the determination of the form of the intersection of two cylinders or cylinder and a cone, together with instruction in oblique and perspective projection. This course, which involves the theory of drafting, is of great utility not only to those who are trying to perfect themselves as mechanical or architectural draftsmen, but to sheet metal workers and any whose occupation requires them to have some knowledge of working drawings, as pattern makers, boiler makers, machinists, etc. In connection with the Descriptive Geometry, practical instruction will be given in the drafting room in instrumental drawing, lettering, etc., for which purpose copies and models of machine and building construction will be available. This instruction will be given to the students individually and for this purpose the drafting room will be open, and an instructor will be present during every teaching hour of the school. A student who takes this course of practical work in the drafting room should be able by the end of the year to read a a drawing without any difficulty, and also to make a fairly good original drawing, and at the end of two years he should be a fairly good draftsman.

The course on Mechanics will embrace the theory of vectors, the representation, measurements and laws of forces and motions, the theory of equilibrium, theory of the lever, pulley, and other simple mechanical powers, the calculation of stresses, theory of the simple beam, the transmission of force and motion, friction, work, energy, power, the efficiency of machines and the elements of machine design. I hope that this brief outline of the courses of instruction will enable intending students to choose wisely the subjects which they most require. But should there be any who are still unable to make a choice, the teachers will be glad to give