middle of an electro-magnetic field and are connected with a high-tension alternator. With a working potential of 5,000 volts and an alternating current of 50 periods per second, disk-flames are produced, which are inclosed in furnaces. By means of blowers 2,649 cubic feet of air are gently forced through each furnace every minute, which amount of air after leaving the furnace is charged with about one per cent of nitric oxide. The temperature of the hot air is reduced from 1,292 deg. F. to 122 deg. F. by sending it first through a steam boiler (the steam from which is used in making calcium nitrate) and then through a special cooler.

After converting the nitric oxide into nitrogen peroxide, nitric acid is formed by sending the gases through towers filled with broken quartz over which water trickles. The solution is conveyed to tanks containing limestone, with which it reacts and produces neutral calcium nitrate. After evaporation, concentration, and solidification the nitrate is obtained in marketable form.

It is stated that by this process calcium nitrate containing 13.2 per cent of nitrogen can be produced at a cost of $20 per ton, and sold for $40. This very respectable profit undoubtedly explains the erection of a 30,000-horse-power plant, which it is said will be shortly in operation.

CARBON DIOXIDE POCKETS IN FRANCE.

In the Auvergne region of France a large amount of carbonic acid gas comes from the soil, and is one of the last traces of the former volcanic activity of this region. All the springs contain a large quantity of the gas. These springs are found generally in the fissures of the ground which allow the water to rise. One of the Montpensier springs in the Puy de Dome region has been long known as the "poisoned spring." Animals which descend into the cavity to drink are soon asphyxiated by the gas which is given off by the water and accumulates here. Bodies of birds, rabbits, dogs, sheep, and other animals are found, and even persons have narrowly escaped. Vegetation is also affected by an overdose of the gas. Spots can be seen running in a line across the fields, where the plants have suffered from gas coming up through the fissures of the ground at different points. Soundings show the presence of a great quantity of gas, and it is usually in a very pure state. Such gas forms a source of commercial value, and could be utilized practically, as is done in Germany at present in Westphalia and other regions. At present the amount of carbonic acid gas given off per day is estimated at one million cubic feet, and this could be much increased. Aside from the gas production we have other interesting phenomena here. The fissures containing the springs occur in a calcareous marl in which the fauna consist of mammiferous animals such as the rhinoceros, crocodile, turtle, and others. Two of the springs are remarkable. Both of them come from cavities from 8 to 10 feet deep, in the midst of clay and mud. Excavations made at 15 feet depth show Gallo-Roman vases, one complete human skeleton, several skeletons of horse, cow, sheep, which have commenced to fossilize. Two feet below this were found remains of the mammoth, with skin and tusks, which indicate an unusually large specimen. Debris of bison bones is found. The cavities form veritable bone-pockets, coming from the local enlargement of the fissure by the action of the spring. The original depth of the pocket seems to be at least 60 feet. Different epochs from 50,000 years to 2,000 years are shown by the various layers of bone deposits in the cavity, which has been filled up by the deposits from the spring, and the water continued to flow through this. The animals and human beings do not seem to have been drawn into the cavity by the stream of water, but they must have descended into it in order to drink, for the access is easy, and were then asphyxiated. Such a fossil-bed in the form of a pocket seems to be unique.

HOW TO STUDY INDUSTRIAL CHEMISTRY.

The recent announcement by the New York University School of Commerce, Accounts, and Finance of an entirely new course in industrial chemistry for the school's first-year students of Business Management raises anew an interesting question. The distinctive feature of the course is that it is to be given to men who have not had any previous training whatever in scientific studies. Not even a knowledge of physics or of the most elementary chemical laws is to be presupposed by the instructor. Nevertheless, the school officials believe that students can obtain from the course a knowledge of the chemical principles involved in the more important industrial processes, which ought to prove of considerable advantage to them in whatever line of technical work they may be engaged. The question is, can so broad and difficult a subject as industrial chemistry be taught profitably in a one-year course?

The circular of the School of Commerce describes the course as follows: "A practical study of the chemical processes involved in the production of various commodities, including iron and steel, copper, and other metals, soap, glass, dyes, and the like. The work will be adapted especially to the needs of men who are connected with manufacturing concerns and do not have a technical education." The instructor is Prof. Martin A. Rosanoff, of the university faculty, who has long been a student of this subject, particularly in its more practical aspects. The course is to have a two-hour session every Thursday evening throughout the college year, and the instruction is to be given principally by lectures and experiments before the class. How widely the New York University plan differs from the ordinary method of teaching the subject, is made evident by a brief comparison with the corresponding courses in other universities and in the technical schools.

The usual arrangement in a four years' college or scientific school curriculum, where considerable stress is laid upon the study of chemistry is somewhat as follows: In the first year the student has one lecture course in inorganic chemistry running through the year for say two hours or three hours per week. Generally there is a first year laboratory course also, in which students perform a prescribed set of introductory experiments. During the second year the student continues his lectures and laboratory work in inorganic chemistry and begins qualitative analysis. In the third year he attends lectures in organic chemistry, and takes up quantitative analysis in the laboratory. In the fourth year his laboratory practice is devoted to organic chemistry, and his lecture work probably to industrial chemistry.

At the end of such a four years' curriculum, wherein the student's time is devoted largely to the study of chemistry, he is entitled to rank as a fairly well-trained chemist. But suppose he should abandon his chemical work at the end of the third year's study. In that case he would still be ignorant of the most important branch of chemistry, namely, the application of chemical laws to industrial processes. Suppose he should stop at the end of the second year's work. He would have no knowledge at all of the chemistry of sugar, the alcoholic beverages, colors and dyes, explosives, and so on through a long list of important products, all of which are outside the range of inorganic chemistry, and therefore still unknown. There are many college and scientific school graduates holding the Bachelor of Science degree who have had two or perhaps three years' work in chemistry, and still have no chemical knowledge that could be of any practical use to them in business life. They do not know the difference between the chemical composition of iron and of steel, or between coal gas and water gas. They have no idea how glass is made, how artificial dyestuffs are produced, or how they should be used; how wood pulp is transformed into sheets of smooth paper; or how basic steel is now made from the impure ores which have lain useless for generations.

Their ignorance, which usually strikes the practical self-educated man as quite incomprehensible, is due simply to the fact that their studies have been based on a wrong idea. They have started out as if they were about to learn all that is to be known of chemical laws and processes, and have broken down before they obtained even a small measure of useful knowledge. Nevertheless, thousands of young men in the colleges and technical schools are to-day following in their footsteps, and will accomplish just as little. Indeed, under the usual college plan of reserving a study of the practical applications of chemistry until the very end of the college course, it is difficult to see how those students who are not specializing in the subject could be expected to derive anything except a certain amount of mental cultivation from their courses in chemistry.

That Prof. Rosanoff is strongly in favor of a simpler and more direct method of training is evident from a recent interview, in which he says: "It seems to me that we ought to discriminate between a knowledge of the essentials of a subject and an exhaustive knowledge of both fundamental principles and details. Just this lack of discrimination makes the education of many men one-sided. Being afraid to ignore anything, they start out to acquire a general education, with the apparent intention of learning everything about everything. The result is that they generally miss just the information and training that would do them most good. In the course in industrial chemistry planned for the School of Commerce an earnest attempt will be made to guide the students in learning essential facts which a thoroughgoing business man ought to know, and in avoiding the pitfalls of fruitless, desultory study. We are not expecting to develop scientists or practical chemists, but we do expect to give useful and needed help to many a young man who is ambitious to increase his technical or commercial efficiency."

The need of such a course as the New York University School of Commerce has instituted is obvious to anyone who has ever been connected with almost any manufacturing establishment. Even those concerns which carry on purely mechanical processes frequently find their operations handicapped by a misunderstanding of chemical laws. It would probably be difficult to estimate how much time and cash has been lost by manufacturers on account of the ignorance of their clerks and salesmen as to the technical features of manufacturing. For this reason the outcome of the New York University experiment will unquestionably be watched with great interest by the officials of progressive industrial corporations. If Prof. Rosanoff succeeds with his students, as we expect and as we sincerely hope, he will have performed a valuable service in pointing out a new pathway for many young men toward efficiency and advancement.

ACTION OF RADIUM ON ORGANISMS.

Experiments to show the action of radium upon the organism have been carried on at Paris by C. Bouchard and V. Balthuzard. In the first experiment, they introduce 30 grains of radiferous sulphide of barium, contained in a collodion bag, into the peritoneal cavity of a rabbit. The substance gives but a small amount of rays, but on the contrary produces an emanation which keeps passing through the collodion bag to the outside. The rabbit decreased in weight from 1.2 to 0.94 pound in five days, and succumbed on the tenth day, after being paralyzed. The autopsy showed a congestion of the lungs and entrails. A guinea-pig used in another experiment died in eight days, while a second animal used as a check, to which ordinary collodion bags were applied, thrived and even gained in weight. On the eighth day the blood taken from the check animal showed 16,000 white and 5,200,000 red corpuscles in proportion to 5,600 white and 4,600,000 red corpuscles for the radium-treated animal. The action of the radium is clearly seen. A small dose, if the emanation is continuous, will kill the animal. The presence of the emanation is found in the tissues of the animal, or localized in the organs, and a photographic plate shows this, especially in the lungs and the super-renal capsules. A closer method is to measure the emanation by extracting it from each organ by the mercury pump and then finding the electric conductivity of such gas. A guinea-pig was treated by radium and the gas extracted from the different organs. After one hour the gas was observed by the electric method to measure the amount of emanation, and under identical conditions. By volumes, the order for the largest amount of emanation is the following: lungs, kidneys, super-renal capsules, spleen, skin, liver. But when taken by weight, we find that one grain of the super-renal capsules contains as much emanation as 4.7 grains of the spleen, 11.4 grains of the lungs, 15 of the skin, 60 of the liver, and 100 of the kidneys. In the above case the animal had been given a subcutaneous injection of 1.5 cubic inches of gas containing the emanation given in four days by 0.4 grain of radium, and it was killed after four hours. The researches showed that the radium increases the zymotic action of pepsin, pancreatin, and the ferments in general. The localizing of the emanation on the secreting glands is to be noticed, and is not without importance in therapeutics. It explains perhaps the stimulating action given by mineral waters upon the secretions, when the water has been taken at the springs. Mineral springs have already been found to give off radium emanations in considerable quantity.

A NEW WIRELESS TELEPHONE.

The Paris journals report that M. Maiche, a well-known inventor, has made a sensational discovery in the field of wireless telephony. His new apparatus consists of two posts which are placed in his premises. Each post consists of a telephone, battery, a special form of induction coil and a frame which is formed of a series of insulated wires. One post is placed in the garden and a second one in a room in the building some distance off, about 100 feet, and several walls, doors, and windows come between the posts. Conversation can be carried on easily, and the sound is clear. The inventor started five years ago to work on the question. At the chateau of Marchais, belonging to the Prince of Monaco, he made experiments using the earth as a conductor, and these were successful at a distance of two miles. One year afterward he was able to communicate between Toulon and Ajaccio in Corsica, over the sea at 180 miles distance, using the sea as a conductor for the waves. These experiments were kept secret, however. As the new apparatus works without the use of ground, the results are more important. He expects to increase the distance indefinitely by giving more power to the apparatus, which is only in its first stages. Submarine boats could use the system to good advantage.

Pre-eminent among the skilled craftsmen of China, the carpenter still maintains the leadership. Though almost invariably wedded to the use of the tools of his ancestors and to their methods, judged by results he is more efficient in his line, says the Engineering Magazine, than are the average of the foreign-trained fitters and machinists in theirs.