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# LABORATORIES THAT TURN OUT PRACTICAL SCIENTISTS

**Work Shops of the Chemistry and Physics Departments of the Omaha High School Showing Students Demonstrating Truths They Have Learned**

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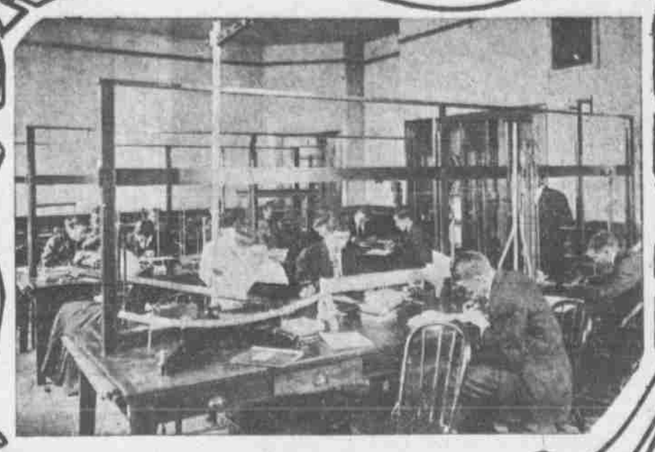

CLASS IN PHYSICS

CLASS 09-10 IN CHEMICAL LABRATORY

CLASS IN CHEMISTRY

ON THE third floor of the Omaha High school are two great workshops of science.

In these laboratories Omaha students seek to release the enigmatical secrets of the universe—the supernatural laws which make the wheels of the earth revolve. These students are doing things in the shops of chemistry and physics, for they have been taught to realize that the development of miracle-working marchinery—the contrivances that drive the wheels of progress—really began with the elementary principles of these mystic sciences.

By slow and painful steps man has learned that the progress of the nations is linked with one source of energy—fire. When man first learned to build a fire he made his start on the long road toward enlightenment. Prehistoric man learned to keep himself warm, to cook his food, to get metals out of ores and to forge them into rude weapons of defense by the simple application of flame. By means of signal fires on the hilltops he flashed his first wireless messages.

Today we have the steam engine, the electric dynamo and motor, the power printing press, the power loom, the telephone, the wireless telegraph and the flying machine. By means of these and countless other inventions one man can do the work of hundreds, the continents are linked together, darkness is turned into light and time and space are vanquished.

Stories of these wonderful inventions, of the struggles of the men who brought them into being and of the patient researches and brilliant discoveries of the men of science, who established the foundation principles upon which all these inventions rest, have their first chapters in laboratories similar to the workshops of the Omaha High school.

The students, it is true, are following the well-beaten trails of the world's greatest scentists, but they are learning for themselves, by personal investigation and practical application, the profound secrets that transcend the ordinary laws by which the universe is governed. Truths, almost incomprehensible, are made known to them through their own efforts. Some day they may learn things about physics and chemistry that are now unknown to science.

## Modern Methods of Teaching

In the Omaha High school, as in all other schools of learning, the methods of teaching physics and chemistry have been revolutionized within the last twenty years. The reaction against the loose and desultory methods previously in vogue was started by the emphasis given to laboratory work in the new text books which appeared from time to time. The movement gained impetus from the influence brought to bear by college entrance requirements, and this pressure resulted in a demand for closer personal observation by the students.

"Practical work is what we demand from the student," says Dr. H. A. Senter, head of the chemistry department, "not cut and dried text book knowledge. We try to teach the student to learn for himself, to apply the book principles to actual and practical life. We want results, too—not the accurate answers worked out to the sixth decimal place by 'doctored' figures and copied data, but real, honest results from intense, personal observation."

Let the uninitiated visit the third floor of the local high school. He may observe a lecture room with a large experiment table in front, in full view of the students' seats, arranged in a sloping gallery. This is the class room and a small part of the science department of the school. The real facts are learned in the laboratories.

In the chemical laboratory one may see a student, attired in a rubber apron, bending over the blue flame of a Bunsen burner and watching the chemical changes taking place within the transparent walls of a test tube. At another desk he may see a student working with large glass jars, from which is occasionally emitted rank, chloric fumes. Another student is busy juggling the symbols and figures of a chemical equation, endeavoring to learn for himself just what action one element may have upon another when placed under certain conditions.

Then in the physics laboratory the visitor views similar scenes. One student is experimenting with that strange, unexplainable, weird magical science which unfolds the phenomena and laws of electricity. Two jars here, in which are placed zinc and copper plates in an acid bath, give off the "juice" by copper wire conductors. From the fundamental stages one may see the telephone, the telegraph and even the wireless instruments in actual operation. Great secrets are unfolded to the students within the walls of the high school rooms.

The new twentieth century methods of instruction have brought out the salient fact that, in their own way, boys and girls have by nature and disposition the keenest interest in physical phenomena.

So far as the science is concerned itself, the most important result of this introduction of laboratory work into the public schools has been the development in the public mind of a widespread recognition of the fundamental principle that knowledge is real and living to the individual, only when it is founded on personally observed facts and personal experience.

## Must Be Interest

In order to progress in any line of human endeavor there must be interest. Cut and dried methods of study are tabooed in the modern class rooms and laboratories. The students are allowed, or rather encouraged, to investigate the unknown themselves.

The mere knowledge that there are four elements which, in a class by themselves are known as halogens, is of no use to anyone. it may as well be forgotten. These elements are chlorine, fluorine, bromine and iodine. This knowledge is of no benefit, either. When the students learn to make these gases in the laboratory and learn the uses to which they may be put in commercial and industrial life they have knowledge of some benefit to them.

In like manner they learn the power of magnetism and the many uses to which it may be assigned. Their human interest is aroused and they investigate these things for their own cause.

The students are first taught to observe the things about them—the environment in which they live—then they penetrate the unknown principles. They study the mystic theory of gravity, the magnetic force of the lodestone, the condition of heat, lighting and the application of electricity, the sources of sound and the secrets of light itself.

All these secrets of nature, the marvelous laws of the universe, are released in the laboratories of science. Modern application and twentieth century methods of research place the truths of the elements before the student in their simplest form.

You take a few pieces of zinc,
And put in your generator,
Add water, then plug in the cork
And pour in H2 S 04.

The action was not very brisk
When I put in H2 S 04,
So I tried nitric acid to see
If the thing wouldn't bubble up more.

As I wiped up the acid and zinc,
And swept up the glass from the floor,
I concluded I'd stick to directions
And try my own methods no more.

This is the woeful melody of the college boy who "did" three solid hours in the "chem lab" and wound up his day's career by blowing a perfectly good experiment to smithereens. It would have ended well, but he didn't follow directions, which simply goes to prove that a fellow can't "monkey" with things in the chemical laboratory.

Dr. Senter further illustrates the "monkey theory" by pointing to the ceiling of his lecture room. The ceiling is spattered and soiled and besmeared with the wreckage and debris of experiments that "went wrong." So violent was one explosion that pieces of cardboard have been imbedded in the plaster—not exactly imbedded, but they are on the ceiling just the same.

## All Necessary Apparatus

On Dr. Senter's lecture table are water and gas fixtures, oxygen and hydrogen generators, a compressed air tank, a vacuum, storage batteries and a hundred and one little bottles and tubes filled with the elements and co-elements of science. If these various things get mixed up in the wrong combination there's bound to be a riot among the elements.

Dr. Senter also has a bellows that he operates with his trusty right foot. Sometimes he inflates tubes by blowing through a test tube, but he always maintains that he can blow just as well with his foot as his mouth. Any student that doesn't appreciate Dr. Senter's humor isn't out for a high grade.

There are 120 young men and women studying chemistry in the high school and there are 120 hearty laughs in his classes every day in the year. He likes his work and he teaches his students to like it, too.

A little journey to the physics or chemistry department of the Omaha High school may be taken most any time of the day. Drop into the "chem lab" and meet Dr. Senter. You'll know him when you see him. Most of him is hidden behind a big rubber apron and the biggest part of his face is covered with a beard of the General Grant variety. Dr. Senter will take you through his laboratory, where he teaches 120 students every day the mystic secrets of the elements and will explain to you the internal workings of his workshop.

In that workshop is everything from the crude candle to a complete electric light plant. It won't take but a moment for you to be shown some of the phenomena of nature. A few things are mixed together and then they begin to work. From a large glass converter a little hydrogen is drawn off into water and little bubbles arise. A lighted taper is touched to the bubbles and there's a report that has the average giant cannon cracker beaten to a kazee. Dr. Senter says the action is caused by the combustion of the gases when H2 is added to O, which gives the chemical equation H2 plus O equals H2 O, whatever that is.

## Come Near Defying Laws

When the students get their chemical paraphernalia lined up and working they come about as near defying the laws of nature as a Wright aeroplane. From the students' workbenches astonishing results are shown in a remarkably short space of time. Little demons of fire, or even the devil incarnate himself, seem to aid in performing the feats of the wizard.

Each student in chemistry at the high school has a large experiment table with individual locker compartment, supplies, etc. Each table is supplied with bottles of acid, various elements, a sink, gas for supplying heat to Bunsen burners, electric connection and running water. Then in the laboratory are various supplies and mechanical contrivances for general use in the laboratory.

Nearly all experiments are performed individually by the students, though there are some that have to be worked out by two operators. Data is recorded and results computed by the students from their personal observation. In this way they virtually learn the secrets of chemistry themselves.

Dr. Senter has a way of arousing intense interest among the young folks in their work. He can talk technical matter in such a way that it is interesting even though it's plain facts and figures. The way he talks sense in a funny way and emits humor and sunshine is just like a slap on the shoulders from a friend when you are feeling blue.

Students are taught to work in his classes, for there is no place there for the drone or loafer. He wants his boys and girls to work and work hard, and he teaches them to work and to enjoy their pursuits. He makes the study of chemistry interesting for them.

In the department of physics it is the same story. The laboratory is the workshop where results are obtained. It is the shop where students get the practical experience and from experiments and deductions the students learn the science of physics.

## Problems of the Gears

The teaching of physics has been a problem that has confronted school authorities for years. Within two decades there has been a complete change in methods. The students are not taught according to the modern system, but they are aided in learning for themselves. They are told how to set up an apparatus and are instructed in the matter of conducting an experiment, but the actual work in the laboratory is done personally by the student, the results tabulated and the deductions made. Such a system gives the mental training that need emphasis and it also inspires in the boys and girls a living enthusiasm for the subject at hand, and develops in them the scientific habit of mind, the ability to utilize knowledge and a just appreciation of the significance of natural phenomena.

Dr. Herbert A Senter is head of the department of chemistry. Along about 1897 he stood before a class in the Omaha High school for the first time and told the crowd to watch him and do likewise. Herbert Senter is a Cornhusker. He graduated from the University of Nebraska at Lincoln and then decided he didn't know all there was to know about chemistry, so he cut the foam for Heidelberg. When he came back from Germany he was Herr Dockter Senter.

Dr. Senter is affability itself. To those who are entente cordiale at his laboratory or class room—and this represents his students and all others—he radiates good nature and good cheer and wisdom and logic. All the students love their teacher, too. He treats them all alike and has no favorites. He is popular with all. Dr. Senter lives on the sunny side of the street and leaves room for others.

Prof. Nathan Bernstein is head of the department of physics. "Nate" Bernstein is an Omaha High school alumnus. After his graduation he went to the White mountains of New Hampshire and matriculated at Dartmouth college. Along about 1902 he knew about all there was to know about physics and came west. He served a good term under the azure skies of Colorado at Trinidad, then came back to Omaha. This was in 1897.

Prof. Bernstein teaches physics, or rather teaches the students to teach themselves. When they learn their lesson well he teaches them that Dartmouth is the best college in the world. He can throw verbal pyrotechnics about things physiological that show that he knows physics from p to s. His greatest formula is "Wah Hoo Wah." He learned this while studying physics up on the Connecticut river on the New Hamphhire side.

# House Boats on River That Have to Be Taxed

RECENT news dispatches said that a couple of the Mississippi valley states are again agitating the question of taxing the houseboats found in their waters. Every once on a while the question is brought up in some state, but it always ends in the houseboat man winning, for when one state gets too hot for him all he has to do is to slip his cable and float away to a shore where the authorities do not bother to collect taxes from a man whose home is upon the waters.

About 1901 Kentucky imposed a license fee of $7.50 on all houseboats, with the requirement that the name and address of the owner and the date the license expired be exposed on the boat in a conspicuous place. This measure was intended more as a police regulation than anything else, as the more lawless of the river gypsies had become bold in their depredations upon other people's property. The houseboat men fought the law on the ground that the Ohio being a navigable river, the commerce upon it cannot be hampered by state taxes. The law was very laxly enforced, however, and no cases were ever pushed to a final decision.

The houseboats are usually scows or flatboats about twenty feet long by ten or twelve feet wide, roughly constructed of two-inch planks spiked together and calked with oakum and rags and the seams made watertight with pitch or tar. A small, low house is built upon the boat and covers about two-thirds or more of it, leaving a cockpit or else a raised platform at each end from which the crew work the sweeps or oars when they are the means of propulsion used.

The house is divided off into from one to five rooms, depending upon the size of the family and the size of the boat. While many are cheaply constructed, others are equal to a well appointed land cottage. In many instances rough bunks or berths are constructed on the sides for sleeping quarters. A cooking stove is set up in the house and its sheet iron pipe projecting through the roof takes the place of a chimney. Some of the boats are operated by power.

The better class are well equipped with furniture, a few even having organs and other musical instruments, but of recent years the graphophone and phonograph have proved the most popular of musical instruments, and when two or three are moored together the crews usually entertain each other in the evening by each in turn placing the instruments on the roof of the boat and playing their entire repertoire.

The crews of these shanty boats, as they are locally named, are well named river gypsies, as they are water nomads. Today they may be found tied up at Wheeling, W. Va., a couple of weeks later they may be at Portsmouth, O.; a little later at Louisville, Ky.; then at Cairo, Ill., whence they float out into and down the Mississippi, stopping on the way at New Madrid, Mo.; Memphis, Tenn.; Natchez and Vicksburg, Miss., and Baton Rouge and Bayou Sara, La., winding up finally at New Orleans. There the boat is sold and the owner and his family return to the Ohio by steamer, to repeat the trip again the next year. There is a fascination about the life which cannot be appreciated unless one has experienced it. The houseboat dwellers are not stifled by convention, for such conventions as they have are of home manufacture. They are a law unto themselves; they pay no rent or taxes and, above all, their life is utterly without responsibility.

The shanty boat folks come from all stages of society. Many are young married couples just starting out in life and hoping in a few years to acquire enough of this world's goods to enable them to settle down on land. Workmen in manufacturing establishments located in the river towns live on the water in order to save taxes and rent. A few invalids seek health outdoors in this fashion and there are some plain tramps who have no higher ambition in life than to get through it with the least possible exertion.

Among the tramps are found the riff-raff of the river, whose lawless practices have caused them to be dreaded by shore people and the better class of shanty boatmen. Most of their time, when they are not stealing, eating, drinking or sleeping, is spent in playing cutthroat euchre, of which they are inordinately fond. Quarrels are of frequent occurrence during these games and sometimes a murder is hidden by the waters of the muddy rivers.

Many of the tramps' boats are run down by steamers in the night, owing to all the crew being drunk or asleep and no light being shown. Many are wrecked on snags or

(Continued on Page Four.)