

CHRISTIAN EDUCATOR

A SCHOOL AND HOME MAGAZINE

QuisBoven

NOVEMBER



H. G. BROWNELL, LOUISVILLE, KY.
PRINCIPAL OF THE MANUAL TRAINING HIGH SCHOOL

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THE CHRISTIAN EDUCATOR

A School and Home Magazine

Edited by FRANK WILLIAM HOWE.

VOL. III.

NOVEMBER, 1898.

No. 3.

GEMS FOR STUDY.

[From the author of "Christian Education."]

THE great work of parents and teachers is character-building.

THE Bible contains a complete system of theology and philosophy.

IT is the nicest and most responsible work in the world to deal with human minds.

IF you have a sharp, bright thought, it is not you who created that thought, but God.

GOD would have us students as long as we remain in this world. Every opportunity for culture should be improved.

GOD entrusts men with talents and inventive genius in order that his great work in our world may be accomplished.

THOROUGH discipline, under a wise teacher, is of more value than natural aptitude and endowment where there is no discipline.

SOUND health lies at the very foundation of the student's success. Without it he can never see the fruition of his ambitions and hopes.

AS the human countenance is stamped by the sunbeam on the polished plate of the artist, so are thoughts and impressions stamped on the mind of the child.

EDUCATION is the enlargement of perception. It is the extension of thought. It is unfoldment. It is growth. It is the flowering of mind and morals. It is the means whereby character is made. It is the charm that gives gracefulness to strength of mind, extension to the range of vision, power and

glory to the whole being of man. Any other object than the uplifting of the human being is unworthy to be called education. — *Susan H. Wixon.*

EDUCATION UP-TO-DATE.

WE teach the children Danish,
Trigonometry, and Spanish ;
Fill their heads with old-time notions,
And the secrets of the oceans,
And the cuneiform inscriptions
From the land of the Egyptians ;
Learn the date of every battle,
Know the habits of the cattle,
Know the date of every crowning.
Read the poetry of Browning ;
Make them show a preference
For each musty branch of science ;
And the other things we teach 'em
Make a mountain so immense
That we have not left a moment
To teach them common sense.

— *Et.*

EXTRACTS FROM "JESUS AS A TEACHER."

CHRISTIANITY is essentially a spirit, and not a letter, or a form, or a dogma.

THAT will be a happy day for the cause of true religion when men come to see the difference between religious and scholastic questions.

A COMPETENT knowledge of men is even more necessary to teachers of morals and religion than to teachers of the branches of secular education.

WOMEN are more apt to possess the intelligence that feels and the feeling that knows than men ; and this is why, for some purposes, they surpass men as teachers.

ALL teachers, to be successful, must be able to appreciate the difficulties and trials of their pupils, and to graduate their instruction to their ability,

furnishing them also the needed encouragement, and particularly in the case of the young and weak. The most successful teachers are characterized by a certain simplicity of character; they are in league with human nature.

THE knowledge of the mind that is found in books of psychology does not answer the teacher's purpose. It may qualify him to teach a man rather than a horse or a dog, but not one man rather than another man, not John rather than James. The teacher must know men in their individual characters as well as their general constitution. He must know minds as well as mind.

THE fundamental truths of religion are directly revealed to the human consciousness, and are not argued out or logically established. Spiritual things are spiritually discerned. Thus the presuppositions upon which the Bible rests are assumed, never established. It is asserted that God created the heavens and the earth, but no attempt is made to prove his existence. The Bible starts with the assumption that this is already known.

God does not reason or think in the sense that he collects facts or data, and then draws conclusions from them,—in the sense that he discovers what he did not know. The Almighty is not an inductive philosopher. He does not proceed by ratiocination, or in fact "proceed" at all. He reasons with men for their enlightenment, but not for his own enlightenment. We do not think of him as learning by experience or as working out problems. The language that best fits the case is that suggested by the sense of vision. God sees, perceives, beholds. His knowledge is intuitive. Nor is the eye of the Lord upon men that he may find out something about them. "Neither is there any creature that is not manifest in his sight: but all things are naked and opened unto the eyes of him with whom we have to do."

MEN also see and perceive, and have intuitions, but only in a limited sense. We observe and register phenomena, classify facts, deduce conclusions and laws, and build up systems; but in science and philosophy we return to the subject again and again; we seek to verify our facts and test our conclusions; and when we have finished,

we are not sure, save in a limited sphere, of our results. Some of the best-known sciences have been largely reorganized within the last few years. We have the "new chemistry," the "new astronomy," the "new political economy," and even the "new mathematics." Particularly in the field of human conduct, where man's will is the governing faculty, we are often uncertain of our way, and sometimes are wholly lost.

TWO VIEWS.

THE catch-penny schemes that are carried into the schools for the raising of money do not belong there. The United States Government does not need such aid. It can build all the battle-ships we need without assistance from the children who have no money of their own. The same principle holds regarding the Lafayette Memorial Fund.

Although the enterprise received President McKinley's endorsement several weeks ago, he approved of the scheme on the ground that educators wanted it, and the appropriateness of the suggestion, and not from the standpoint of an educator. These things in large part are nuisances. They make the lives of poor children at such times uncomfortable and unhappy, and open the way for various benevolent enterprises that have no right to be brought into the school.—*Normal Instructor.*

To revive the historic fraternalism of which Lafayette's name is significant will be a wholesome thing for both nations. It is also highly appropriate that the proposed monument is to be mainly the gift of American school children, for these have ever been taught to revere the memory of Lafayette as one of the chiefest heroes of our triumphant war for popular liberty. To signalize the closing year of the century by such a recognition of French generosity in our time of trouble as would be implied by the erection of a noble and worthy monument over the grave of Lafayette, by the school children of America, can not fail to evoke the warmest enthusiasm all over the French Republic and do much to cement an enduring friendship between the two nations.—*Learning by Doing.*

MENOMONIE, WIS., Oct. 23, 1893.

To the Editor:

Your October number delights me. I think the EDUCATOR "bears the divine credentials" in a remarkable degree. Find enclosed a few addresses for sample copies.

MRS. M. M. AMES.

GENERAL ARTICLES

THE LOUISVILLE MANUAL TRAINING HIGH SCHOOL.

THE first attempt to introduce manual training into the public school system of Louisville was made in 1880, but it was not until the summer of 1890 that an appropriation was made by the Louisville School Board to cover the cost of a wood-working equipment and the salary of an instructor. A frame building was at once erected on the campus of the Male High School, and was equipped with the necessary tools and benches for a class of twenty-four boys.

On Sept. 1, 1890, Mr. H. F. A. Kleinschmidt, a graduate of the St. Louis

in the following February it was necessary to purchase additional tools, and the number of pupils was increased to forty-eight. In September 1891, ninety-six boys were admitted; but the practise time was cut down to forty-five minutes daily.



THE OLD AND THE NEW.

Manual Training School, was elected teacher of manual training, and began work in October with a class of twenty-four boys, chosen from the freshman class of the Male High School. The boys devoted one hour before the regular daily session of the high school began, to a lesson in mechanical drawing, and two hours after its close to shop practise. So popular was this exercise work that

training course. In this he did not succeed, but in the spring of 1892 he laid before the Louisville School Board a proposition to purchase a suitable lot, and to erect upon it buildings sufficient to accommodate three hundred pupils; to equip these buildings with all the furniture, apparatus, and tools necessary for a manual training high school of the first order, and to convey the property, when

In the meantime Mr. A. V. du Pont, one of the wealthy citizens of Louisville, who was greatly interested in the efforts of the School Board to establish a manual training school, had attempted to raise by subscription sufficient money to erect and equip a suitable building commensurate with the demands which were being made for a manual

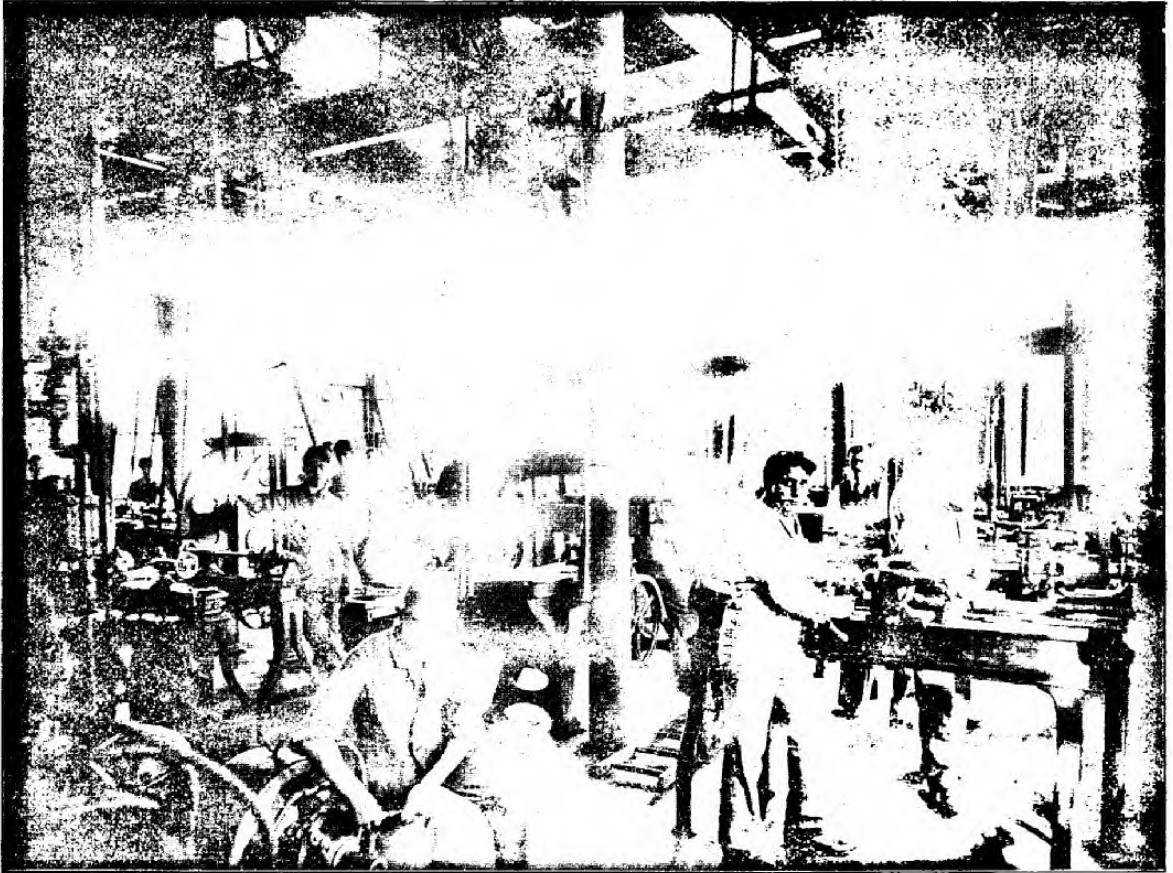
complete to the Louisville School Board in trust upon certain conditions. The principal condition was that the Board should maintain in the buildings a manual-training high school as a part of the public school system, free to all white boys in the city who were qualified to enter the Male High School.

This proposition was at once accepted by the Board, and Mr. du Pont lost no time in putting his plan into execution. Ground was broken in June, and in October, 1892, the school was opened with an enrolment of one hundred and twenty

Louisville which is the result of the benevolence of one of her citizens.

Mr. H. F. A. Kleinschmidt, who gave instruction in drawing and wood work in the frame building on the Male High School campus, became the principal of the new school. He took an active part in the design and equipment of the buildings, in the selection of a faculty, and in the preparation of a three years' curriculum.

The course embraced three years of work in English language, literature, and history; three



THE MACHINE-SHOP.

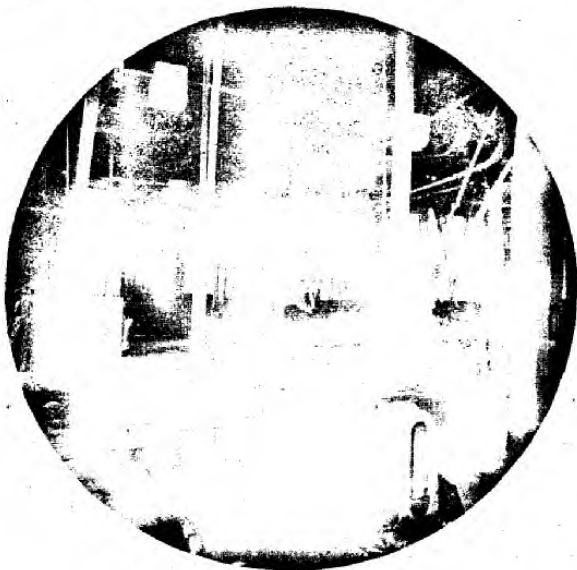
pupils, and a faculty composed of a principal and six instructors, which at the beginning of the next scholastic year was increased to twelve members. The buildings were completed in the spring of 1893, and were formally turned over to the School Board in May of that year.

A few days after this event the city was shocked by the sudden death of Mr. du Pont. The loss the city sustained in his death can hardly be measured in words. The Manual Training High School stands to-day as the only public institution in

years of mathematics, beginning with elementary algebra and concluding with plane trigonometry; three years of science, including mensuration, physiology, physics, and chemistry; three years of drawing, beginning with free-hand pencil sketches and concluding with shaded, architectural, and mechanical drawings; one year's work in the wood-shop, another in forge and foundry work, and the third in the machine-shop. The course was modified three years ago by the introduction of two years' study of German.

Every department is provided with its own special equipment. There is a reference and loan library of several hundred volumes for the English department. The physical laboratory occupies three rooms, and is well equipped with apparatus for both research and experimental work. The laboratory course covers elementary work in mechanics, heat, and electricity. The engines, boilers, dynamos, and motors of the power plant are used as pieces of laboratory apparatus whenever occasion demands them. There is nowhere in Kentucky a better-equipped chemical laboratory than that on the top floor of one of the buildings of this school. It occupies three rooms which are used respectively for general class room, analytical laboratory, and balance room. The drawing-rooms are equipped with the necessary models and tables, but pupils are required to furnish their own tools and paper.

The whole third floor of the shop building is devoted to wood working. Two large rooms are equipped with benches, lathes, and tools sufficient to accommodate one hundred and twenty boys, each working ten hours per week. All shop work is done from drawings made either by the boy who is doing the work or by some other boy in one of the drawing rooms. This plan is followed to as great



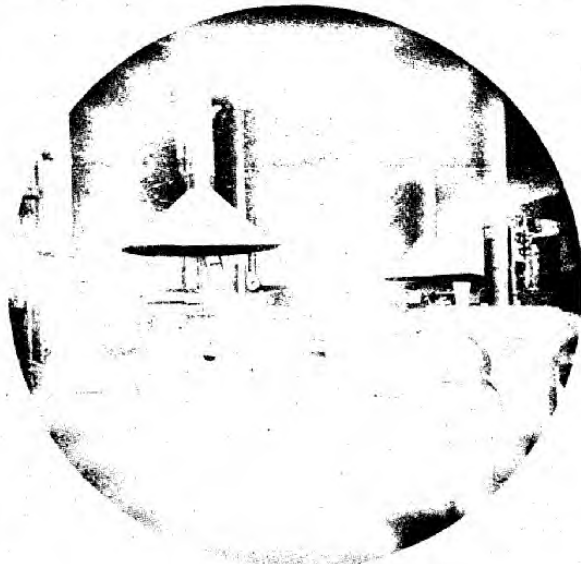
THE WOOD ROOM.

an extent as possible throughout the shop course, so that whether the boy is making a square stick or a steam engine he works to scale and from a drawing.

During his first year the student spends about three hundred and seventy fifty-minute periods in

the wood shops. His first work is to plane up a stick square. With this as a beginning, his course continues through joinery, turning, pattern making, cabinet work, and carving.

Some manual-training instructors contend that all this should be accomplished by a series of set



THE FORGE ROOM.

exercises, and that no finished articles should be made. Experience has taught us, however, that greater interest is maintained, and that much more is learned by the pupil, when appropriate "project" work is inserted from time to time. This work becomes more difficult as the pupil acquires skill, and finally culminates in patterns for machinery castings, in bookcases and writing-desk cabinets, and in various other useful and ornamental objects.

During the pupil's second year he spends about the same number of hours in forge and foundry work that he did the previous year in wood work. There is not the same opportunity here for making beautiful project pieces that there was in the wood shop, and the work is a little more like drudgery; but the educational value of these exercises is fully as great as are those in wood. The first exercise is not with hot iron, but consists simply in beating out on the anvil a small ingot of lead into a square bar of given dimensions. The final exercises are the making and tempering of cold chisels, lathe tools, hammers, and other tools.

About sixty hours are given to practise work in the foundry. White metal and brass are cast. Molds are made from patterns which were produced in the wood shops; and these patterns were made from drawings executed in the drawing-rooms.

The seniors' shop course is the most difficult, the most interesting, and the dirtiest, in the whole shop curriculum. The boys enjoy it, however, and there is less tendency to shirk work in this department than in any other. The machine-shop is equipped with thirteen engine lathes, two planers, two drill presses, one shaper, and one universal milling machine, besides speed lathes, grindstones, a gas forge, and all the small tools which necessarily accompany such machinery. Ten periods per week throughout the year are devoted to ma-

The seniors spend two hours each week in making drawings for work to be done in the various shops. This drawing is done under the supervision of the principal, and for the time being the class is converted into a draughting-office force with the principal as head draughtsman. Such drawings as are perfectly accurate and neatly made are traced in ink. From these tracings blue-prints are made for use in the shops.

It has been customary in most manual training schools to make use of a daily program or sched-



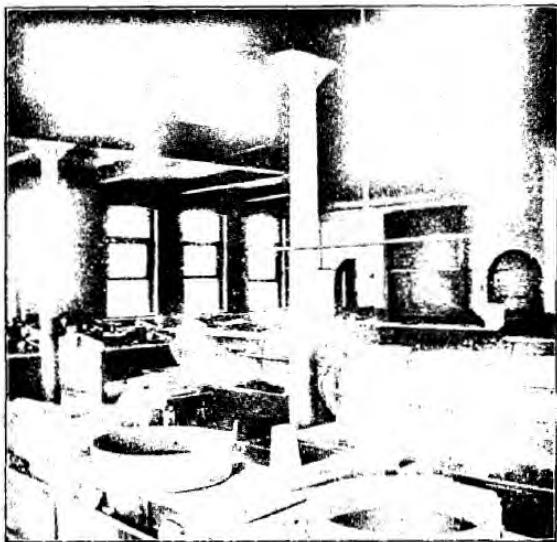
THE FREE-HAND DRAWING-ROOM.

chine tool work. After the first few preliminary exercises, all the work turned out is of value. Every piece made has its place in some machine which is under construction.

A number of speed lathes are now being made for the wood shops, and it is intended ultimately to finish about fifty of these. Besides this standard work, there are always numerous small jobs to be done for the laboratories or in repairing machinery, so that almost every conceivable form of machine tool work is available for instruction.

ule, allowing two periods each day for shop work, one for drawing, one for laboratory work, and one for each class-room recitation. With pupils who have just entered from the graded schools, this scheme works very well, but with the higher classes much more may be accomplished by the use of a weekly schedule with longer shop, laboratory, and drawing periods than can be accommodated in a daily schedule. The shop periods in this school vary from one hundred to two hundred minutes, or two to four recitation periods, and the drawing

and laboratory periods are nearly all of one hundred minutes. This gives the pupil time to complete a laboratory experiment or a shop exercise in one period. It saves time by making it unnecessary to set up apparatus or machines more than once for one experiment or exercise. The best feature of the weekly program, however, is the absence of a "daily grind." Variety is just as truly the spice of a pupil's school life as it is of his home life.



FOUNDRY.

It will be seen that it is not the purpose of this school to fit boys for any special vocation, or to teach any trade. Many of the graduates of the institution are now in engineering schools; some are teachers; many are draughtsmen; and others are students of law and of medicine. Comparatively few have become machinists or craftsmen of any sort, and it has been clearly demonstrated that in intellectual ability, graduates of this and other manual training high schools, rank with graduates of classical high schools.

H. G. BROWNELL.

Louisville, Ky.

MANUAL TRAINING IN RUSSIA.

"PUBLIC schools in Russia must henceforth teach not only the usual common branches, but also give their students the acquirement of a trade." The Russian Minister of Education, Bogolpov, has issued the following edict, which is copied by the Berlin *Tageblatt* from *Public Education*, St. Petersburg.

In addition to the studies thus far required of students who are preparing to become teachers in our public schools, the Seminaries [normal schools] must furnish to, and require of, each student thoroughness and efficiency in a definite *Handwerk* [hand work — trade — manual training in carpentry, blacksmithing, masonry, baking, etc.]. This is to be taught to all students in the public schools. The selection of the *Handwerk* is, for the present, to be left to the pupil and his parents.

Careful study and close observation must be exercised by all educators to equalize, and to give instruction in such branches as the demand of the various trades calls for, thus preventing an overproduction or lack in any particular line of work, and yet meet the constant growing demand for an all-round citizen educated for usefulness.

It should not be understood from this, that Russia has, as yet, definitely determined to inaugurate manual training immediately in all her public schools; but she is evidently getting ready to do so in one day whenever she chooses. The fact that nearly all the school-teachers in Russia—as in other European countries—are men, makes this requirement of learning a trade less rigorous than it would be in America. And the teachers will be better, as teachers, for learning the trade, even if the teaching of manual training should not immediately become general in the schools of the nation.

The Russian experiment is scientific in beginning with the teachers, rather than in allowing children to be experimented upon by non-teachers. A blacksmith employed in school may be a good blacksmith, but if he is not also a teacher, he can not be as successful as one who has been trained to teach blacksmithing.

It may be asked, How can a normal student acquire a practical trade experience in a normal school?—European law generally requires that any graduate before he can receive a school or class must work one or two years with an experienced teacher,—mostly without compensation. If this work shows that he is fit and can be recommended, he receives a government position as teacher. So with the normal trade student the requirement will be to go into actual shop practise until he has acquired the necessary practical experience to be entitled to teach.

Lastly, we may notice that Russia is making the attempt to develop symmetrical citizens, by raising manual work to a proper level, by satisfying the demand for trained workers, and thus abolishing class distinctions by making the knowledge of some practical line of work a requirement upon every future citizen of the empire. We may learn from Russia.

C. V. S. BOETTGER.

THE GOSPEL IN GEOGRAPHY.

SCIENCE is knowledge. Natural science is the science of nature. Nature is that which God has created, and in nature God manifests his power, his love, his life, his character,—himself. In every individual manifestation of nature and in every individual operation of nature, is a revelation of the Word of God, for “by the Word were all things made.” More than this, every individual manifestation and every individual operation of nature is the life of God, for “all the host of them” were made “by the breath of his mouth.” Still further, every individual manifestation and every individual operation of nature is a revelation of the “power of God” and of that power “unto salvation;” but unto salvation only “to every one that believeth.” Every manifestation and operation of nature contains, then, the gospel. Jesus said that man should live, not by *all* the words, but “by every [individual] word which proceedeth out of the mouth of God,” and as every manifestation or operation of nature represents a word of God, nature in each of its parts reveals the gospel to the believer. All then who truly receive a complete knowledge of natural science “shall be delivered from the bondage of corruption into the glorious liberty of the children of God.”

Of all the branches of natural science, probably no one is more inclusive than the one with which even the youngest child is more or less familiar; namely, geography. Geography is a description of the earth and of its inhabitants. As soon as the child is old enough to recognize the things about him, he commences this study. He is, in fact, a young natural scientist, and as soon as he can talk of his wonderful discoveries (for such they are to him), his numberless questions of how, and when, and where, and why, soon disclose the ignorance of many of us who are older. The primary education of the child is for the purpose of enlightening, and directing, and molding this busy little brain; and this work, we are told, “is the nicest ever assumed by men and women.”

To the Christian, God is the teacher; and he has penned his first lesson in the first verse of the first chapter of Genesis: “In the beginning God created the heaven and the earth.” Here is the germ of the whole thing. How simple, and yet how complex! In its simplicity, it furnishes the first

geography lesson for the primary child; and, in its infinite complexity, there is too much for one lesson to the oldest and wisest and most experienced student. It is the epitome of the entire Word, and of all the works of the Creator. Such is the first science lesson which the Master of Science gives his children; and how wonderfully he has adapted it to all ages! It is God’s first word to man, and in it is included all that he ever said afterward. The worldly-wise, after having spent centuries on its study, are still unable to fathom its depth or fully to understand its meaning; for the riches of the wisdom and knowledge of God are unsearchable, and his ways past finding out. But “by faith we understand.”

The first chapter of Genesis, which supplies material for several lessons, is so simple a development of the first verse, that again the child has access to God’s lesson-book, and again the older student finds an inexhaustible field of research. Here is opened to his mind every branch of natural science,—geology, astronomy, zoology, botany, physiology, physics, the true science of government and religion, as well as arithmetic, grammar, music, and art,—all of which are touched in the departments of geography,—mathematical, physical, and political.

In the study of mathematical geography, the student discovers the shape, size, and motions of the earth, and its position in the universe. He compares this earth with the vast creation and learns that all its nations are “but a drop in the bucket,” and as “the small dust of the balance,” and in a new light he sees the great love of God in the infinite sacrifice which has been made to redeem *him*, so small a part of that one drop.

In physical geography he learns the origin of the world and its condition at the time when it was “without form,” void, dark, and covered with, and surrounded by, water. But as God is a God of order, a God of purpose, a God of light, his first work upon the earth was to establish order and create light. This God made us, and though darkness exists on every hand, yet we may hear his voice say to our souls, “Let there be light.” Then the mists were cleared away, and the beautiful firmament filled the space. Continents and islands appeared, and the boundaries of the ocean were fixed. At first the earth was barren, but as God abhors barrenness, whether physical or spiritual, he immediately clothed it with a living carpet of green, and

decked it with flowers, rich in color and delicate in perfume. Stately trees also beautified the landscape, which was diversified with rolling hills and watered with streams from the river of life. But God was not satisfied with decking the earth; he glorified the heavens with the sun and the moon, and studded it with glittering stars—the golden buttons on the robe of night. God could not stop even here, but filled water and air and covered the face of the earth with animal life. Every creature was docile and obedient to the requirements of the man whom God now made in his own image to have dominion over all. And then when God beheld the result of his work, he said it was very good; for “upon all things in earth and air and sky he had written the message of his Father’s love,” and “he designed the whole natural world to be an interpreter of the things of God.”

Political geography deals with man in all his relations in life. Studied aright, this branch teaches the Christian student the perfect social condition of the race as God intended it; for “God made man upright,” even “in his own image.” God never meant that a savage or half-civilized race should inhabit this fair earth. The industries which God gave man were all a pleasure, and were for the purpose of developing and ennobling all his faculties, and revealing to him the character of the God who had created him. His government was one of perfect love and freedom, for so Christ had created man, and “whom the Son makes free, he is free indeed.” Everything which surrounded man was for the purpose of revealing God and his love.

In every respect, God’s thoughts for man were thoughts of peace, and his only prohibition was, Thou shalt not die. But, strange infatuation! Man chose death, and how terrible and far reaching the blighting consequences! God must now teach a different science lesson—the results of sin and the hope of salvation. To do this he must adapt his lesson-book to man’s fallen condition, so the fair face of the earth is changed, and instead of life, death reigns both in man and in all created things. Not only was man’s character changed, but his food, clothing, shelter, industries, government, religion, language, education, and his position on earth—all were changed. Even the atmosphere and the climate, the surface and the structure, of the earth were made to teach the results of sin. Now the rugged mountains, the showers of rain, the snow and the dew, and even the stones, as well as all vegetable and animal life, teach this new lesson. Every physical feature of the earth reveals the blight of sin and the plan of salvation.

Man, too, has changed: physically, mentally, morally, he has fallen. God’s mission now is to seek and to save that which is lost, and he even condescends to receive man back into his confidence, and allow him to co-operate with Him in this work. Political geography now teaches the Christian student to look upon the world as the field. Every continent, every country, and every city becomes to him an object of his love and sympathy. As instructors of youth, we know that the more completely we understand the home surroundings and influences of an individual, his disposition, either hereditary or cultivated, his mental, moral, physical, or social advantages or disadvantages, the better fitted do we become to give such help and sympathy as will tend to restore in him the lost image of God. Geography gives us this knowledge of the nations of the earth, so that as we labor for the Master, whether at home or abroad, we may be successful in gathering souls into the heavenly garner.

But the past and the present condition of the earth is not all there is in the study of geography. There is a future, a new heaven and a new earth, and this is even more comprehensive than was the first creation of the heaven and the earth. Geography as God would have us study it does not leave us in an earth darkened and blighted by sin, but points us forward to the city which “has foundations whose builder and maker is God,”—to that earth which is “glorified through redemption and made still more beautiful than at first, for in Christ we become more closely connected with God than as if we had never fallen.”

This is how God would have the students in our Christian schools instructed in natural science, a knowledge of which is a knowledge of God, whom to know is life eternal. As we consider these important truths, we are led to exclaim, “Who is sufficient to be a teacher of these things?”—Only one, Christ, the great Creator and the only true Master of science. To him all must come. Teachers and students alike must sit at his feet to be taught of him. And as we learn, we shall all say, “Surely, never man spake like this Man.”

SARAH E. PECK.

Cooranbong, Australia.

SCIENTIFIC STUDY.—III

HEAT.

In our last study we considered some of the phenomena of sound; in this, I shall note a few of the properties of heat, that manifestation being

the next higher in the scale of vibration. That heat is one of the manifestations of vibration, needs no discussion; but the subject of heat has, for several reasons, never received the careful study that the other forms of vibration have. The importance of this field of physics has not been fully realized, nor the bearing it has upon the whole display of God's love and care for man.

In the field of sound we have a definite scope of vibration; as, for instance, we know that when we lessen the number of vibrations per second to a point below 32, they cease to be recognized as tone, but merely as separate strokes or shocks; likewise when we increase the number of vibrations to 36,000 or more per second, the human ear ceases to respond at all to the sensation. The same is true of light. When the vibrations reach about 400,000,000,000-000 per second, we get the lowest form of light, or the red ray; and when we increase the vibrations to about 800,000,000,000,000 vibrations per second, we get the violet ray,—the highest manifestation that the eye recognizes. Above this point it ceases to be light. But with heat this is not so. How low the vibrations go, we do not know. Cold and heat, each being but the absence of the other, become only relative terms. It is estimated that interstellar space has a temperature of some -240° F. What the number of vibrations can be per second at this extremely low temperature, we do not know; and it is only as we are able to compare its higher manifestations with light that we can judge the nature of heat. We consider an object as being hot even before the vibrations have become sufficiently rapid to produce the red ray of light. The close relation existing between chemical affinity and heat, is such that definite experiments along this line are exceedingly difficult to make.

Heat, like sound, is usually conducted better by solids than by gases. Water is a poor conductor, while dry air is one of the poorest. To illustrate this with water, one may freeze a small piece of lead within a bit of ice. Place this in the bottom of a test tube, fill with water, and apply heat at the upper end of the tube by inclining it over an alcohol flame. The lead will keep the ice at the bottom of the tube and it will still remain frozen for some time after the water begins to boil at the top. This experiment shows how poorly water conducts heat, yet dry air is a far worse conductor, and the ether is supposed to be equally poor.

Inasmuch as heat will traverse a vacuum, we might consider it as traveling in the ether, and as being hindered or accelerated in its journey by the

introduction of various gases, fluids, and solids in its pathway. Any artificial heat that human ingenuity has been able to produce seems, however, to be largely devoid of the power of progression that is so universally seen in what we call "solar" heat. Why is this so? I again ask the question that was asked in the June number of the EDUCATOR, How can a "solar" heat ray, as such, reach us after having spent nearly eight minutes in its journey of some 93,000,000 miles from the sun, surrounded by a temperature of at least -200° F.? There can be but one of two answers given,—either solar heat differs materially from any known form of artificial heat, or else what we term "solar heat" does not originate, as heat, in the sun at all. This, however, will receive further consideration later on.

When we realize that sound, heat, light, and electricity, are but different manifestations of one and the same force, we readily discern how one of these manifestations may present itself to our senses in an entirely different form from some other manifestation of the same force. There is some truth in what is stated by Steele in his work on "Physics," where he says, "While the pupil, for convenience, uses the terms heat, light, and chemical rays, he should bear in mind the truth that these rays differ not in quality, but only in pitch."

Heat-force drives the molecules of a body into longer vibrations, and so increases its size. This expansive force of heat, acting on a given body, is enormous. A rise in temperature of 45° C., which may occur during a summer day, will lengthen a rod of wrought iron, ten inches long, $\frac{1}{200}$ of an inch, and if its ends are fastened, it will exert a strain of 50 tons. On cooling, it contracts with the same force. The long heavy spans of our iron bridges, that settle but one fourth of an inch under the strain of a loaded train of cars, rise and fall two or three inches between the heat of a summer day and the cool temperature of the following evening. It is for this reason that railroads must be laid with open joints, or else the expansion and contraction of the steel rails between the extremes of natural temperature would destroy the road. Between 4° F., and 100° F., the expansion of one mile (5,280 feet) is five feet and seven inches.

In our next we will study the subject of light, which promises many interesting topics for consideration.

OTHO C. GODSMARK, M. D.

Avoid public reproof. Let your government be from heart to heart.—*H. C. Krebs.*

THE RIDER AND THE CHARIOT.

Look on the spirit as the rider; take
 The body for the chariot, and the will
 For charioteer; regard the mind as reins,
 The senses as the steeds, and things of sense
 The ways they trample on. So is the soul
 The lord that owneth spirit, body, will,
 Mind, senses, all, itself unowned. Thus think
 The wise.

He who is unwise drives with reins
 Slack on the neck of the senses; then they romp
 Like restive horses of a charioteer.

He that is wise: with watchful mind and firm
 Calms their wild fire, so they go fair and straight,
 Like well-trained horses of a charioteer.

— *Edwin Arnold.*

BIBLE PSYCHOLOGY.—I.

In a former article this definition was quoted from the author of "Christian Education:" "Education is but a preparation of the physical, intellectual, and moral powers for the best performance of all the duties of life." This recognizes the powers of man as being physical, mental, and moral,— a triunity of faculties in a unity of being. We may assume, then, that this triunity of powers includes the whole man,— at least all that can be educated. If there are any other terms in common use as indicating man's faculties, we should be able either to identify them with these three, to include them within the three, or else reject them entirely.

This three-part nature of man's constitution has not been clearly distinguished in current psychology, so far as the writer is acquainted with it. Neither in popular theology has the three-part nature of *man* been generally affirmed. If, then, we find it recognized in the Scriptures, we shall at once have gained an initial point of view from which the whole subject can be seen more clearly than ever before. The Scriptures must, of course, be received as the Word of God, who created man and *knows* him to the uttermost, far better than he can know himself. If I thus accept the Bible as the fountain of all the *truth* that I *can* know about myself, I shall find that all the *facts* of experience and observation are in accord with it— *provided* that I understand aright both the Bible and the facts.

Here it may be useful to note the distinction between truth and fact. A fact is something that

is or that *has been done*. Truth is something that anticipates all facts, makes them possible, and hence is always in conformity with real facts. Truth is the whole body of constitutional law; facts are the particular acts and statutes that are wrought out under the constitution and written down in human experience. Truth is the eternal principle; fact is the principle *worked out* in time. Facts illustrate and point to the truth; truth illuminates and transfigures the facts. And as in human affairs the constitution determines valid legislation and execution, so truth determines *what are facts*. And reason is the supreme court that observes whether assumed facts are in accord with truth. But the supreme court may err and have to reverse itself, if it does not itself follow the constitution: so human reason is sure to err if it does not fully grasp and follow the truth as guide. The authors of the constitution are the real interpreters of its meaning; so the Author of reason must interpret to us the truth. He must operate our minds, and not we his.

Approached in this attitude, the Bible should give us unforeseen revelations of truth and fact in the subject of psychology, enabling us to see the truth underlying facts already known, and to discover other facts heretofore unknown. Naturally, the first problem of the subject is to understand the composite nature of man. For example, I am to discover, if possible, whether man is a triunity of physical, mental, and moral factors, and what these are; whether he consists of two factors only; or whether he is the product of four or more.

Now, there are at least two scriptures that clearly describe man as consisting of three elements; they are found in 1 Thess. 5:23 and Heb. 4:12. The first speaks of our "whole spirit, soul, and body;" and the second enumerates the "soul and spirit," and "the joints and marrow,"— the last two belonging, of course, to the body. Both of these passages recognize the body, soul, and spirit, as distinct elements; as closely connected, and yet as definitely distinguished, as the joints and the marrow of the body. And the first passage distinctly affirms that these three are the "whole" man, and that the sanctification of these is to be sanctified "wholly." So we are at once warranted in the conclusion that all of man is embraced in his physical, psychical (*psyche*, soul), and spiritual natures. The factors are three,— not two, or more than three. Whatever confusion there may be in uncaredful lan-

guage or obscure theology concerning the soul and spirit, we may be assured that the Scripture recognizes a distinction between them. And whatever may be the ultimate meaning of the body, soul, and spirit, as distinct each from the others, we may expect always to see that there is a distinction between them *when we have studied* enough. The method of "comparing scripture with scripture" is not only Biblical but in the highest sense scientific. So with our fundamental conceptions rightly formed, every term relating to the constitution of man, whether used in the Bible or elsewhere, should yield to the understanding its own definite meaning.

Possibly such a scientific study of psychology — scientific because Scriptural — is not so difficult as it would seem. Perhaps we already have, ready-made but not critically discerned, the proper words and modes of thought with which to approach the study. We have seen that the Bible recognizes man as body, soul, and spirit. This is the *truth*; what are the *facts* of experience that illustrate it? Does our common, unstudied manner of speech also recognize man as a triunity of physical, psychical, and spiritual elements?

It may be affirmed that all men, savage or civilized, believe in a hereafter in which man's condition will be determined by the character of his temporal life. Likewise all agree that the essence of character is the *moral* element, the rightness or wrongness of man's life-record. And this fact of moral responsibility and of moral faculties is discerned by man through the exercise of his mind, or *mental* powers. It is also the testimony of experience that man has a body, or *physical* being, in which and through which the mind acts and the spirit grows. The physical, mental, and moral powers are all the testimony of experience, — the facts that illustrate the truth of Scripture.

Several questions at once arise, however: What is the mind? What is life? What is the soul, and the spirit? We should find them all answered in the Bible; we should expect to find them all embraced in the three general terms. But first it would be well to put all these representative terms together, and take a comprehensive look at them. They may be all arranged in sets of three, thus: —

Corporal,	Mental,	Moral.
Physical,	Psychical,	Ethical.
Material,	Vital,	Spiritual.
Hand,	Head,	Heart.
Person,	Life,	Character.

The Scriptural terms that in some sense correspond to and include these are —

Body,	Soul,	Spirit.
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To these may be added for further illustration the following suggestive groups: —

Physiology,	Psychology,	Ethics.
Sensation,	Cognition,	Volition.
Vegetable,	Animal,	Human.
Thought,	Word,	Deed.
Faith,	Hope,	Love.
Assimilation,	Organization,	Elimination.
Matter.	Space,	Motion.

It would not be difficult for the student of Scripture and philosophy to point out many beautiful analogies between these groups as arranged in the last list; they are not suggested here, however, for the purpose of *affirming* any such necessary or seeming relations, but only to illustrate and emphasize the dominance of the "triple alliance" in man's thought of himself and his relations. The "sacred number," three, evidently stands for a necessary mode of man's thinking, — possibly in some sense corresponding with the threefold manifestation of the Creator in whose image he was made. The Scriptures are full of these triple relations, the significance of which ought to be carefully studied. It is generally agreed, however, that three is a symbol of completeness; and it certainly may be so considered in the study of this subject.

We have now observed that the Bible presents the truth that man has a threefold nature. We have also seen that the facts of human thought and experience illustrate and confirm this truth. It now remains to distinguish these three elements, each from the others, —

What is the body; the soul; and the spirit? ¹

FRANK W. HOWE.

MEMORY TESTS.

PROFESSOR ALFRED BINET, the eminent French psychologist, has made some very interesting experiments on the persistence of memory. Some of these furnish instructive tests for use in school and home exercises. One of the simplest of them is conducted as follows: —

A series of figures is read to the subject at a regular speed (generally two figures per second) and without any special accentuation. As soon as he has heard the series (having been told beforehand of the requirement) the subject endeavors to repeat the figures without error, and in the order in

¹The readers of the CHRISTIAN EDUCATOR, especially those who are teachers and Bible students, are earnestly invited to send in early answers to the last question, and to make any corrections that seem necessary in the studies as presented.

Address such communications to the Editor personally.

which he heard them. The experiment is repeated several times, beginning with a small number of figures; e. g., four, which any one can give correctly; it is then increased to five figures, then to six, and so on, until a number is reached which the subject can no longer repeat correctly; care is taken to repeat each trial, and to allow sufficient intervals of rest to avoid fatigue and the confusion of figures in the memory.

Such tests on special numbers or figures do not furnish any absolute index of the power of the memory as a whole, since they involve other mental factors in a greater or less degree. Thus the subject employs not only his memory but also his powers of voluntary attention. This explains why children retain fewer figures by this method than adults; their inferiority is due to the fact that they have less control over the attention. The average educated adult retains seven figures; a child from six to eight retains five; a child of ten retains six. A difference of a single figure is of considerable importance in the results, and it is one of the drawbacks of this method that we can not operate with fractions of figures. Such experiments are useful, however, as giving some knowledge of the phenomena of the mind; but they throw no light on the essence of mind itself.

SPIRITUAL HOME EDUCATION.

ALL education should be religious, and the spiritual interests of the child should not be a once-a-week or even once-a-day affair, but rather a constant evolutionary environment. Right results will never be achieved until in every act and thought of parent-life lives the Spirit of the three abiding elements of Christlikeness,—the never-failing faith, hope, and charity. The child in whom a sense of oneness with God has been early awakened, and who is daily and hourly believed in, inspired, and loved, in his home, will find in his home the pathway to heaven, and will be at one with God in early youth.—*Caroline Hardy Paton, in the New Crusade.*

PRINCIPAL'S OFFICE,
MT. VERNON (O.) ACADEMY,
Oct. 25, 1898.

Editor Educator:

I am particularly impressed with the EDUCATOR's proposed articles on "Bible Psychology." I believe that you are entering a field that will prove of the greatest value through careful study. I most heartily welcome your effort in this department.

J. W. LOUGHHEAD.

The Reading Circle

[THIS subdepartment is maintained as a guide to independent or reading-circle study for parents and teachers. This year the work is based on Professor Hinsdale's "Jesus as a Teacher" and "Horace Mann and the Common School Revival in the United States." The first must be of positive value to every teacher who agrees in the world's judgment that Jesus was the greatest teacher that has ever appeared in history; and the second should be of particular value to every teacher in American schools; both are among the latest and best products of the author's long-continued service in public educational work. Note "Extracts" on pp. 61, 62, and last cover.]

"HORACE MANN."

CHAPTER III. HIS SCHOOLS AND SCHOOLMASTERS.

Topics.—Birthplace; Family Status; Reserve between Mother and Son; Early Industry; First Schooling; No Oral Instruction; Reverence for Books; Lack of Nature Study; Village Library; Pastor's Influence; Death of Brother, and Its Effects; Unitarianism; Intellectual Stimulus of New England Preaching; Enters Brown University; Law Studies and Tutoring; Preference for Science rather than the Classics; Admitted to the Bar; Ability as an Orator; State Representative, and Senator; Interest in Philanthropic Causes; Marriage, and Death of Wife; Removal to Boston; Social Powers; Interest in Phrenology; Its Two Principles; Its Influence on American Education; Summing up of Mann's Education; Knowledge not a Panacea for Evil.

"JESUS AS A TEACHER."

CHAPTER V. HIS RELATION TO TRADITION AND LEGALISM.

1. *Topics.*—Jewish Legalism; Milman's Description; The Tradition-building Process; Its Effect; The "Fence;" The "Corban" System; Jesus' Relation to the Sabbath; The "Unlawful Use of Law."

CHAPTER VI. HOW JESUS USED THE SCRIPTURES.

2. *Topics.*—Jewish Classification of Old Testament Scriptures; The Pentateuch "Five Fifths of the Law;" The Jewish Scriptures and the Greek Scriptures; The Inspiration of the Scriptures; Jesus not a Critic; The Fulfilment of the Law; of the Prophecies; Expanding of the Meaning of Scriptures; Thorough Knowledge of the Scriptures; Used for Doctrine, Argument, and Illustration; Jesus and Socrates; Form of Quotations Rarely Literal; The Aramaic Version; The Targums; Dependence upon Memory; The Principle of Accommodation; The Principle of Moral Perspective; His Implicit Reverence for the Scriptures.

3. *Special Quotations.*—"The hungry sheep looked up and were not fed. . . . Nothing is more common than for men to be ignorant of themselves. . . . The whole cycle of Sacred Books He accepted as of divine origin. . . . Waiting upon the teaching of the Rabbi was eating the husks on which the swine fed. Waiting upon His teaching was sitting down at the feast that the prodigal's father spread. . . . Sacred history is something quite different from secular history. Its aim is not the enlargement of the understanding. Its motive is not the gratification of an intelligent curiosity. It looks to faith and life."

MAXIMS FOR THE READING CLASS.

SENSE is more important than sound.

Read nothing without a definite purpose.

A good imitator is not necessarily a good reader.

We read silently ten times where we read aloud once.

Don't try to "read like you talk" unless you talk right.

Labored articulation is distracting both to reader and listener.

A piece that is worth reading at all is worth reading well.

Read no book by an author who is without literary standing.

Rapid reading is as bad for the mind as rapid eating is for the stomach.

No part of the physical organism responds more quickly to right training than do the organs of speech and voice.—*Learning by Doing.*

NOTES ON GEOGRAPHY.

OUTDOOR MAP-MAKING.—Many children not only tire of drawing maps on paper, but fail to get right notions of relief and relative direction. An enterprising Kansas teacher, with the assistance of her pupils, made an outdoor map of her State in a vacant pasture near her school. The ground was so chosen that its natural inclination corresponded with the general slope of the State. The rivers were furrows, the counties were surveyed and marked by drills, and the whole made accurately to scale. It was the marvel of the whole country,—and raised the teacher's salary fifteen dollars a month. Rural school patrons appreciate interest and practical ability. It is so in your State. Prove it.

THE HAWAIIANS probably belong to the Polynesian family. They originally came from Savaii, one of the Samoan Islands. They are, as a race, more industrious than most tropic peoples. Honolulu, the capital city, is thoroughly cosmopolitan in its character. It has electric lights, street-cars, telephones, and many other of the appliances of a modern city. It has about 25,000 inhabitants. The avenues are shaded with tropical foliage, and many of the houses are of modern architecture. The majority, however, are of one story, with wide piazzas. Taro, a curiously prepared dish, is the staple article of food for the natives.—*Teachers' Institute.*

A QUERY FOR THE PHYSICS CLASS.

THE books tell us that no energy is ever lost; thus the chemical energy in coal becomes mechanical energy in the steam engine, and this, in turn, becomes electrical energy when the engine turns a dynamo, which energy becomes mechanical again when the current from the dynamo is employed to run street-cars, or electromotors. When we wind up a clock spring, the muscular energy we expend is held in the spring, and is used to run the clock during the next week.

Now suppose we wind up a stiff spiral spring and then immerse it in a strong acid until the spring is entirely dissolved, what becomes of the energy expended in winding the spring?—*Learning by Doing.*

To stay wound up, the spring must be held by some kind of a clasp, and if this clasp should dissolve first, the energy of the spring would expend itself on the acid; but the question supposes that the spring stays wound up until it is entirely dissolved. We pass along the question, What becomes of the energy stored up in it?

QUESTIONS ON GOVERNMENT.

1. What does the word "government" mean?
2. What is our American idea of good government?
3. What kinds of government do we call bad?
4. What was President Lincoln's favorite way of describing the American Government?
5. Why is our Republic a government of the people?
6. Why is it a government by the people?
7. Why is it a government for the people?
8. What does the Constitution of the United States say of the purposes of our government?
9. How is justice established and maintained?
10. How is domestic tranquillity insured?
11. By what means does the government provide for the common defense?
12. How does it promote the general welfare?

[The foregoing questions are taken from "The Citizen's Catechism," and are answered therein; but in order to increase interest in the subject of good government, we repeat the offer made last month in connection with our flag lesson. The publishers will send the CHRISTIAN EDUCATOR and the Youth's Instructor free for six months to the first school that sends us the best set of answers to these questions,—the Instructor for the pupils' library and the EDUCATOR for the teacher. The school must be below the high-school grades, and the teacher must certify to the originality of the work. Enclose one or two stamps for any necessary correspondence. Try this plan for getting two excellent magazines for your school. Send for sample copies, to CHRISTIAN EDUCATOR.]

HOW TO SECURE ATTENTION.

1. Manifest an interest in the subject you are teaching.
2. Be clear in thoughts, and ready in expressions.
3. Speak in your natural tone, with variety and flexibility of voice.
4. Let your position before the class be usually a standing one.
5. Teach without a book as far as possible.
6. Assign subjects promiscuously, when necessary.
7. Use concrete methods of instruction when possible.
8. Vary your methods, as variety is attractive to children.
9. Determine to secure their attention at all hazards. — *Edward Brooks*

QUESTIONING.

THERE are numerous questions the child asks beginning with *what*. What is that? (The horse.) After a time he begins his questions with *why*. Why do you put in salt? Why do we roast potatoes? These last questions show an expansion of the reasoning power. We do certain things, but do we know *why*; we put units under units; why? We draw a line; why? We commence at the right hand to add; why? The pupil must be confronted with this word *why*, because it compels him to give a reason; to give a reason compels him to use his reasoning power; the educated person is a person with large reasoning powers. — *Teachers' Institute.*

THE gravest criticism on our schools is that they are constructed almost solely with regard to the interests of the few bright children who can be carried upward to the educational pinnacle of the college or university. But no reform of this condition must be permitted to go to the other extreme and neglect the youth of high possibilities, in order to serve the mediocres. A free roadway to the highest summits of knowledge must still be kept open, even though we may abandon the hopeless task of trying to force all children to travel in it. — *Learning by Doing.*

AUGUSTA, MICH., Oct. 12, 1898.

To the Editor:

The EDUCATOR contains an almost inexhaustible supply of matter for thought and study. The help I get from it is invaluable.

DELLA L. CHATFIELD.

THE STUDENT WHO WINS.

- Is a plodder.
 Has high ideals.
 Is always on time.
 Is frank and manly.
 Takes plenty of sleep.
 Lays broad foundations.
 Is thoroughly in earnest.
 Is loyal to his instructors.
 Believes in the golden rule.
 Does his level best every day.
 Is not in too much of a hurry.
 Plans his work and works his plan.
 Takes a due measure of physical exercise.
 Is willing to have his weak spots pointed out.
 Is patient in the presence of the greatest difficulties.
 Does not allow his mind to be filled with athletic nonsense
 Does not allow social life to encroach upon study hours.
 Is the staunch friend of every fellow who is having an up-hill fight.
 Has definite aims, and works steadily toward their attainment. — *Er.*

NOTES ON ENGLISH.—NO. 3.

Use of the Comm. — The presence or absence of a comma often has an important influence in a sentence. A few examples may serve as exercises for discrimination. They are all from an article on "Printers' Errors" in *Macmillan's Magazine*: —

These lines were written by a gentleman who for several years has lain in the grave for his own amusement.

To show the enthusiasm with which our troops have been received, we may mention that we have been told of several instances where cabmen have driven soldiers from Egypt to the barracks without charge.

It has become quite the fashion of late for ladies to take their tea in their hats and gloves.

A large man, eating shark was captured in mid-channel.

Next came Lord Roberts riding. On a gray Arab steed wearing a splendid scarlet uniform, covered with medals on his head, a field marshal's hat with plumes in his hand, the baton of a field-marshal on his rugged feature: a smile of pleasure as he acknowledged the thundering cheers of the crowd!

Mr. Spenser once wrote a statement which was understood thus: "Whales are not fish, because they possess fins and a fish-like tail." What did he intend?

"COMPRISE" AND "COMPOSE."—These two words are often used as if they were interchangeable; thus, "Nine houses comprise the whole row." Strictly, the row comprises—includes—the houses; and the houses compose—make up—the row. The error of interchanging these terms must be apparent, however often it appears in newspapers or in the speech of people who should know better. "Newspaper English" frequently demoralizes the taste of uncritical readers.

MISUSE OF "ABOVE."—"The above" is a very objectionable expression, bettered only slightly by adding "cited" or "mentioned." Recently the writer heard "the facts mentioned above" in a sermon, evidently written out and memorized before delivery. Such a form of expression frequently gets misplaced in "making up" a printed page so that the thing referred to is *lower* on the page than the reference "above." The word "below" is open to the same objection, though the adroit editor of a certain Michigan school paper recently avoided punishment by changing "below" to "above" at the bottom of one column when the paragraph referred to began at the top of the following column. Such references, however, are nearly always backward, to matter in the same column or some preceding column. Such use of either "above" or "below" is awkward and uncertain, and can always be easily avoided in favor of a smoother and more specific reference.

Still another misuse of *above* is to be condemned; as, "The army numbered above twenty thousand men." Twenty thousand is not necessarily "above" nineteen thousand or nineteen units. Number has no such vertical relations whatever. "More than" is meant in all such cases, and should be said.

"COMMITTED."—In one of the sentences used in a preceding paragraph many teachers would say "committed before delivery," or, similarly, "You may commit the paragraphs on page twenty-three." We may commit a blunder, a suicide, or any other crime; we may "commit" a parliamentary question by referring it to a committee; but in no proper sense can we commit a sentence, a paragraph, or a page. What we do is to *learn, memorize, or commit it to memory.*

CORYDON, PA., Oct. 15, 1898.

To the Editor:

Please send me some sample copies of the EDUCATOR. I will use them to the best advantage possible.

E. A. WILLIAMS.

Queries for Students?

[This is a standing subdepartment for the benefit of all who are *students*. It should enable every one to read the EDUCATOR and every other paper more intelligently. All these "Queries" are taken from the articles in this number of the paper, or directly suggested by them. They are excellent for general information exercises in the school and home. The EDUCATOR will be glad to credit the best set of answers to these questions, sent each month, by school or individuals.]

1. What is?—ratiocination, "the new psychology," Unitarianism, the "Socratic method," argon, phrenology, a "wheel barrel," a pneumograph, a spirometer, the "internal intercostal" muscles, "newspaper English," the "Black Death."

2. Where is?—Savii, Liberia, Fashoda, Hampton Roads.

3. Distinguish between—the exact, natural, and physical sciences; quadrangle and quadrilateral; cu. in. and c. c.; the bees shown on pages 82, 83.

4. Pronounce—zoology, abdomen, Louisville, Des Moines, St. Louis, Cincinnati.

5. Meaning of?—cuneiform, dentifrice, propolis, asphyxia.

Editorial Notes.

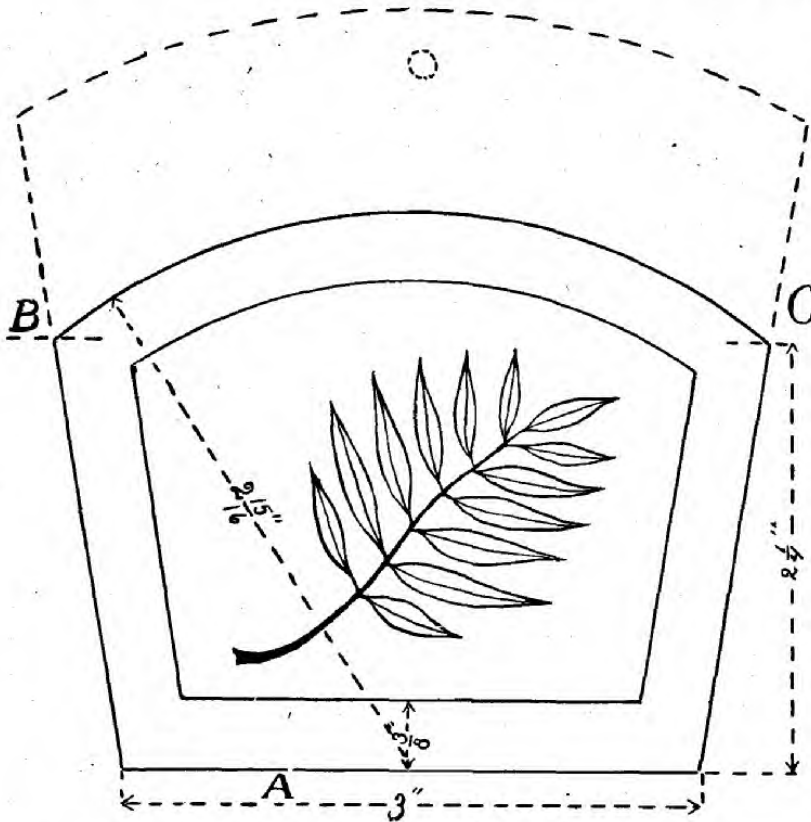
THE EDUCATOR desires to get the name of every teacher, school, and home that makes regular or occasional use of our monthly "Queries." Many are using them for general exercises, and they may be made still more valuable by suggestions from all who are interested. Note our offer to publish credit for the best set of answers received each month. We have not sufficient space to reproduce the answers themselves, but wish to give suitable recognition to all who find the questions helpful. For school use it is not necessary that all the students should themselves be readers of the EDUCATOR. Though the "Queries" arise in EDUCATOR articles, they have an independent value, and can usually be answered easily from the reference books in every school. In responding to this request, please use a postal card addressed to the editor personally, with any answers, questions, or suggestions you may have to offer.

We are somewhat surprised at the responses so far sent to the proposition which appeared in our "Notes on English" in the October EDUCATOR, page 46. The returns thus far received are not all that could be wished in clearness of distinction between the forms ending in *ing*. We have decided to let the proposition stand until our next number, in order that others may improve on these answers if possible. Perhaps the problem looked so "easy" that some considered it beneath their effort. Those who have already written are at liberty to try again. In any case, the *best* answer will be published next month, with comments or additions if deemed necessary for a thorough explanation of the terms discussed. Send your answers, and get the EDUCATOR free for six months.

Conducted by A. J. BRISTOL, A. B.

EDUCATIONAL HAND WORK.—NO. 5.

HAVING devoted some little time to simple outline forms, it will now be well to introduce a line of work at once simple and pleasing in the various ways in which it may be used. As a simple model we have devised a little brush-broom holder, in whose making will be involved the new exercises of joining pieces of wood in simple construction, and line-cutting ornamentation.



The sides being simple rectangles two and five-sixteenths-inches by one inch in size, and the piece forming the back being without ornamentation because of its obscure position, we will first give direction for drawing the front of the holder, which is shown actual size in the full lines of the cut. As in the previous work, the pupils should first make a free-hand drawing from the teacher's model, indicating the dimensions as in the cut, and then from this make a mechanical drawing, actual size, from which they work with the wood.

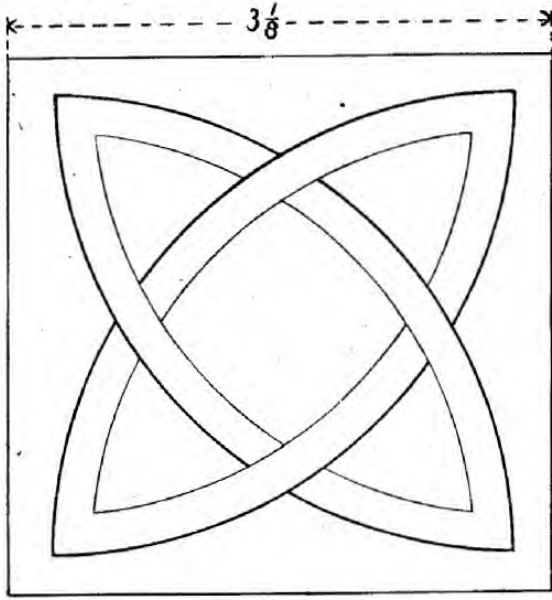
As far as possible get the children to decide beforehand how they should proceed to make this outline; and then have them first draw the line forming the base three inches long. Two and one-fourth inches from this and parallel to it draw the short dotted lines to extend a little beyond the ends of the line *A*; and from its middle point as a center, with a radius of two and fifteen-sixteenths inches, have the pupils draw the arc cutting the dotted lines at *B* and *C*, and connect these points of intersection with the ends of the base line to complete the outline. This furnishes a simple way of getting the angles at the base, which might be obtained with the protractor in schools equipped with them.

The rest of the full lines are to be cut in the wood in the manner illustrated on the next page. The drawing for the figure similar to the one forming the edges of the piece can be made by using a radius two and nine-sixteenths inches with the same center as before; while the sides are obtained by measuring three eighths of an inch from the margin in two places on each side to be sure that the lines are parallel.

The central figure may be varied according to the skill of the various pupils. Of course the one shown will require some skill in free-hand drawing, and may be too difficult for some of them to cut. A pentagonal

star with two points below makes a very harmonious design for this outline, and is very easy to cut, but rather difficult for young pupils to draw. This may be obviated, however, by the teacher's giving measurements from one that he has drawn mathematically correct, in a manner similar to the way the outline above described was produced.

On the next page are two designs that may be of help in suggesting simple forms for line cutting, if the leaf is too difficult at first. Being actual size, no explanation will be necessary further than to



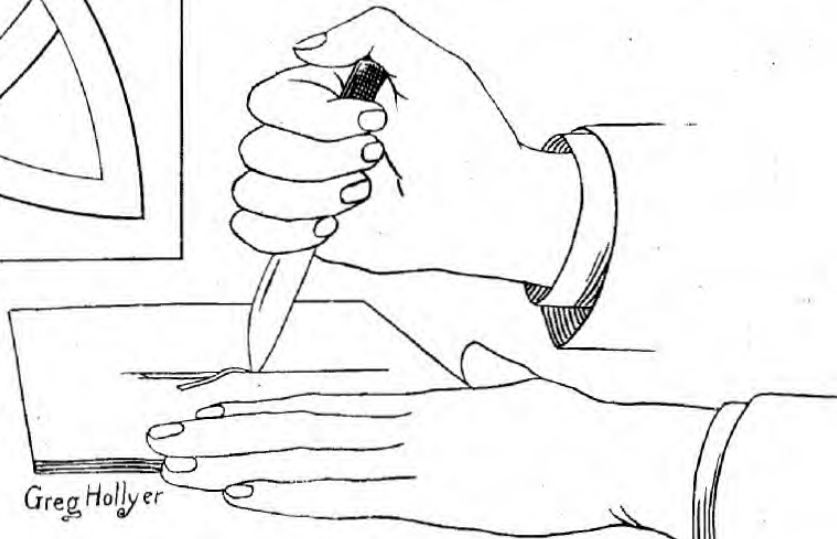
say that the dotted lines are for construction, while the full lines only are to be cut.

The cut adjacent shows quite clearly the manner of holding the knife in cutting out the line. It is best to incline the knife to the right, and then reverse the piece for the other side.

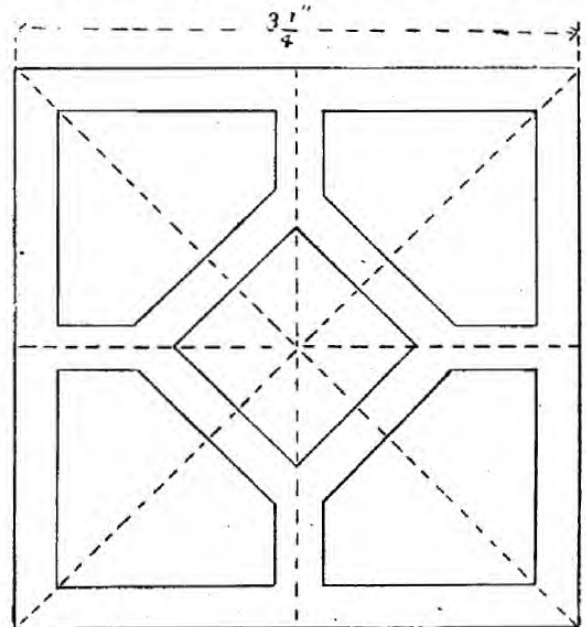
This will give a clean-cut groove where the two cuts meet directly below the mark in pencil. The work looks the neatest when the groove is not more than a thirty-second of an inch broad at the top. Of course the thoughtful teacher will have the pupils do the simpler parts first, and gradually proceed to the more difficult. It might be well to have them try on some simple design before attempting to carve the block for the holder. And if you find they have too much difficulty with it, do not let them attempt the leaf design, but substitute a simpler one lest they become discouraged. If it is attempted, the ribs of the leaflets will look better when made by a single vertical cut.

For this work of carving it is better to have the stock a little thicker than has been used before, — say three-sixteenths or even one-fourth inch thick. It is too frail if only one-eighth inch. This will give greater latitude for the little inch wire brads to be used in joining the parts. It is also well to smear with a good liquid glue the edges of all the pieces that are to be placed against the side of another piece. It will assist in holding the pieces in place for nailing, as well as to make the work stronger after it sets. By questions get the pupils

to tell the order of steps in joining the parts. Drive the brads about through the front and back pieces, smear with the glue only the edges of the side pieces that will fit against the back piece, and then be sure that it is in the right position before the brad is driven in so far that it can not be withdrawn if necessary. Now will come a very practical test of the squareness of the edges of the pieces, and will show the pupils the necessity of giving heed to this matter in their whittling.



Query. — What single word will sufficiently describe the outline of the face of the holder? Could it be called a quadrangle, or is it a quadrilateral figure?



WORK AND WORRY.

"STUDYING too hard," "overworked," are charged with many deaths, but in the majority of cases most unjustly. Trouble kills, but it is a very rare thing for a man to think himself to death, unless his thoughts are intimately connected with something painful and distressing. Study is a boon to the student. He would rather study than eat. The greatest students have lived long and happily, to fourscore and beyond. Thought is to the brain what exercise is to the physical constitution; it keeps the channels of life clear, the blood-vessels unobstructed, and the vital fluid courses along them, distributing newness of life and vigor of action to the latest hour of existence, while the want of thought brings stagnation to the circulation, and causes man to drivel and sleep in old age—dead as to everything except eating and dozing and cowering over the fire. Men may study hard, and after fifty may study with comfort and advantage for five, ten, and fifteen hours day after day; and if the studies are pleasurable they promote the general well-being of the system, both physical and mental, if only abundant sleep is had, with a regular supply of simple and nourishing food, sitting down to meals in pleasant moods, and allowing a good half-hour before study is resumed. Many of our literary men die prematurely, not from over-study, but from depressing mental states and irregular or excessive eating and drinking. It is high pressure and constant tension rather than steady, continuous labor of body or mind, which hurries multitudes to their graves years before their time. With all haste there is impatience, solicitude, worry. In the present age we fear that everything is sacrificed to "hurry."—*Public Health Journal.*

A FARMERS' READING COURSE.

Now is the time to plan your home reading for the winter. The long evenings in the farm home furnish an ideal condition for study. Envied be the man who has the opportunity, and the disposition, surrounded by family at fireside, to study with his mind while resting in his body. The early mornings, long days, and late repose of the busy summer season, find their compensation

in the cheery, studious delights of winter's blessing. Every season has its virtues. Pity'd be the wanton who spends all the long winter evenings in sleep or mental stagnation.

The Michigan Agricultural College has arranged an excellent reading course for the benefit of farmers and their families who wish to make a special study of some particular agricultural subject. Let the EDUCATOR send in your name for a free circular of information.

A HANDY BUCKET SINKER.

It is not always possible to lift water with a patent pump; it is sometimes necessary to lift it with a bucket; and if the bucket is of wood and the well is deep, it is something of an art to fill it. When the curb is icy and the rope frozen and the chill wind blowing, you want something that can be depended on to work right and work at once. A writer in the *Agricultural Epitomist* thus describes it:—



A, bucket; B, bail; C, weight to sink; D, wire holding weight; E, loop to keep rope out of water; F, rope. Get a large iron nut or other piece of metal. Pass a small wire through it and fasten to the bail of bucket at the handle. This weight remains on the well-bucket all the time, and never fails to sink it. The loop E is also of wire, and by its means the bucket can be sunk and filled without wetting the rope or the snap which fastens rope to the bucket. This arrangement is very handy on cold days.

THREE QUESTIONS.

As the young cross the threshold that leads from the school or college life out into the world of stern reality, they find themselves confronted by three important questions: "What do you know?" "What can you do?" "What are you?" Though the world has seemed to attach most importance to the first question, the last two are vastly more important than the first, and the last of the series most important of all.

Unfortunately, most of our attention in educational effort has been given to enabling the young man or woman, on graduation day, to answer the

question, "What do you know?" largely to the exclusion of either of the other two. How often do we hear the remark, "He is *so* smart," while very little thought is given as to what the boy can *do* in the world to benefit and bless those about him, or as to whether he is, in heart and life, *good and true and pure*.

The time has fully come when the young should seek, and those charged with the duties and responsibilities of our educational work — parents, teachers, and school officials — should give, an education that will be a leading forth of all the God-given powers, — the physical and the moral no less than the mental, — of the hand and heart as well as of the head. In other words, let the education of every boy and girl be such that they can answer the question as to *doing* and *being*, as well as that which relates to *knowing*. — *Youth's Instructor*.

SOME USES OF SALT.

USED in washing the hair, salt will prevent it from falling out.

A teaspoonful of salt in the lamp will make kerosene give a brighter light.

Added to a bucket of water, salt forms a remarkably effective fire-extinguisher.

A handful of rock salt added to the bath is the next best thing to an ocean dip.

As a dentifrice salt and water will not only cleanse, but whiten the teeth and harden the gums.

New calicoes soaked in a strong solution of salt for an hour before washing will retain their colors better.

A few handfuls of salt thrown on the fire in the stove will quench the "burning out" of a chimney. (Then clean the chimney.)

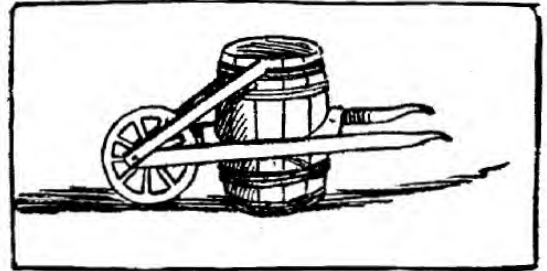
Ink stains may be removed by the use of moistened salt. When it becomes discolored, removed it and use a fresh supply, until no color remains.

A little salt in raw or boiled starch will prevent the irons from sticking, and make the starch whiter. If the irons are rough, lay some salt on a piece of muslin on them, and rub until they are bright and smooth.

It is commonly said that soap will "set" fruit stains on the hands; but it is not commonly known that the fumes of sulphur will remove fruit stains, soap and all. Wash the hands with soap and water, and while they are still wet, hold them over one or two lighted matches. The stains will vanish.

A WHEEL BARREL.

ONE of the most important things to be observed in preserving the family health is the proper disposal of the slops and refuse from the kitchen. In the cities there are special ordinances and officials that compel the maintenance of sanitary conditions; but in the country there is much indifference to their importance. It is easier to throw the dish-water and vegetable parings out of the back door than to — cure the typhoid fever. The only deterrent in many cases is the unbearable odors that arise, and even these are not potent in the winter season. So anything that lightens the duty



of properly disposing of kitchen refuse should be welcomed as a domestic and public blessing. Such a thing is illustrated in the foregoing figure taken from the *New York Tribune*. In the winter a sled can be substituted for the wheel.

SPEAK GENTLY.

TRAIN the voices of your children. Do not let them grow up with harsh, disagreeable voices, which grate on the ear every time they speak. French parents are very particular about this, and that is one reason we admire the manners of little French children. They are seldom rude and coarse when playing among themselves. They have games which teach politeness; and some of the street songs and games played by the children of French peasants are almost as pretty as our kindergarten songs and plays.

A learned writer says: "There is no power of love so hard to get and keep as a kind voice. A kind hand is deaf and dumb. It may be rough in flesh and blood, yet do the work of a soft heart and do it with a soft touch. But there is no one thing that love so much needs as a sweet voice to tell what it means and feels; and it is very hard to get and keep it in the right tone."

One must start in youth and be on the watch night and day, at work and play, to get and keep a voice that shall speak at all times the thoughts of a kind heart. It is often in youth that one gets a voice or a tone that is sharp, and it sticks to one

through life, and stirs up ill will and grief, and falls like a drop of gall on the sweet joys of home. Watch it day by day as a pearl of great price, for it will be worth more to you in days to come than the pearl hid in the sea. A kind voice is to the heart what light is to the eye: "It is a light that sings as well as shines."—*Trained Motherhood.*

A CHEAP ICE-HOUSE.

THE building should be situated on ground that is high enough to drain the surface water away from it, as it has no floor. It is 16 x 16 x 10 feet, the walls made double with an eight-inch space between the outside and inside sheeting. This space is packed with straw and chaff, pounded in as closely as possible. A good roof that will not leak is required. Boards with battened cracks will prove all right and much cheaper than shingle.

But one opening is necessary, the door through which to put in and take out the ice. This is about two and a half by four feet square and eight inches in thickness, to correspond with the walls of the building, and filled like the wall with chaff or straw.

Before packing, fill the bottom of the room with about eight inches of cinders or some such substance as will readily absorb water. Pack the ice on this, leaving a space of from eight inches to a foot between the ice and walls to be filled in with sawdust, chaff, or straw. This should be tramped in as tightly as possible. All the cracks and crevices between the ice-cakes should be filled in with pounded ice, making the mass as compact as can be. Ice put up in this way will not melt down a foot in the whole season, if the sun, rain, and air are excluded, and a reasonable chance given it to drain off the little water which comes from it.—

J. L. Irwin, in Agricultural Epitomist.

THE DISCONTENTED FARMER.

THE really discontented farmer is one who neglects his home and his business. He finds time to loaf in town while his fences remain unrepaired, his farm implements unsheltered, and his stock in like condition. He sees no work to do outside the field, and upon his place there is no fruit, in orchard or bush, and the farm is as barren as barren can be. He takes no pride in trees and green yards, and everything shows the spirit of "don't care." There is an air of having been deserted about the door, and in all places where the handiwork of man should show to advantage.

We shudder when we pass such homes and wonder if life beneath such a roof must not be almost a burden. The front yards and porches are almost disreputable in their stages of untidiness, clutter, and confusion, and we know the housewife within must be lacking in spirit and ambition, and that she is either densely ignorant or dreadfully discontented.

Unambitious content with to-day is not to be lauded, for under such conditions we should never make progress. There is in every ambitious heart a spirit of unrest sufficient to spur one on to attempts to reach higher, and to a better, more remunerative plane. But it is the indolent and improvident who are most discontented among our farmers, take it the world around. The busy ones and ambitious ones have neither time nor inclination toward discontent.—*Nellie Hawks.*

TRANSPLANTING LAWN GRASS.

MUCH time and labor is spent in keeping up the appearance of lawns by patching up the worn or dead spots, generally by setting new sod or resowing the seed. Both of these plans have disadvantages compared with a method described in *Vick's Magazine* for October, which may be used late in the fall. We borrow the following illustration and



description, the upper figure showing a single tuft of lawn grass, and the lower a group of these transplanted. "The method of procedure is to prepare the soil finely and finishing it to be perfectly even; then obtain some sods of good grass and cut them into small pieces, say one or two inches square.



These pieces are then set at regular intervals of nine to twelve inches over the entire surface to be converted into lawn, firming them well into the soil by foot pressure. One great advantage in thus making a sward is that with a very little care not a weed need be carried into the new lawn, a thing not avoidable by either seeding or the ordinary sodding. Should there be dandelions, plantains, or the like in the sods to be used, by dividing as small as prescribed all such can be left out. Another advantage over regular sodding is that it does not require more than one twentieth of the sod to stock a given area. An advantage over sowing is that no risk is incurred of the seeds not catching."

NATURE'S LABORATORY

Conducted by A. W. KELLEY, PH. D., M. D.

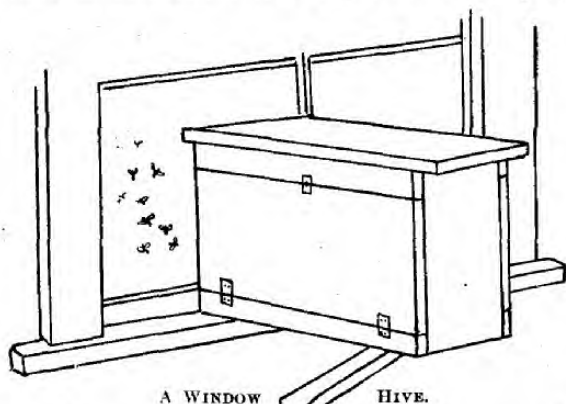
NATURE STUDY.—NO. 4.

AUTUMN STUDY OF THE BEE.¹

“Why do the honey-bees suck from the clover
Sweets upon sweets through the long summer day?
They work to have honey, a plenty and over,
When all the bright summer has vanished away.”

ONE of the most interesting and instructive nature studies for the autumn is the study of bees and their work. And one of its most valuable moral lessons for the student is the lesson of co-operation and industry.

If possible, it is well to have a hive in the school-room, so that observations can be made daily by



the children. The best hive for this purpose is one made of glass, having doors of wood, which can be let down while the observations are going on. It may be fastened to the window-sill, with an entrance through the window-frame, so that the work of the bee may go on uninterrupted. However, if this can not be done, much valuable work can be done during the fall in the study of the materials used, and the products manufactured, by bees. These can be easily obtained, and with them experiments may be performed which will awaken in the child an interest not only in the study of the bee, but of all other insects.

When children understand that the home of the honey-bee is usually a hive, perhaps the thing to study first will be the *materials* he puts into his home; therefore we may begin with these.

¹This article is a partial description of the Nature-Study work followed in the practical Training Department of the State Normal School at Ypsilanti, Mich. Other articles will be presented from time to time during the year. They will be suggestive of much that can be done in every school outside of the study of books.—Ed.

1. **PROPOLIS.**—What is it? where gathered? how carried? for what used?
2. **POLLEN.**—What? where gathered? kinds? where carried? use? where stored? how covered?
3. **NECTAR.**—What? how gathered? where carried? kinds best liked? into what manufactured?

Note.—The teacher may be obliged to tell the children about the *nectar*, or, better, wait until spring and let them find it in the flowers themselves.



WORKER.

After these topics are completed, we may begin a study of the *products* manufactured by the bees.

1. **COMB.**—Of what made? shape of cells? Note arrangement of tiers of cells; size; why some are large and others small. (Some *brood-comb* will be necessary to illustrate this.) Try to discover *why* cells have this shape.

Note.—Allow children to draw squares, triangles, cylinders, and pentagons; and see if by using any of these, the bee could economize space, wax, and labor.

Experiment.—Take some empty comb, fill it with water, and then hold it upside down and shake. What do you discover?

2. **BEE-BREAD.**—What? use? where stored?

Note.—Comb containing bee-bread can easily be obtained. Tell the children enough about its use so that they will be interested when spring comes, in watching the bees gather the pollen to help make the bee-bread.

3. **WAX.**—What is it? use?

Experiments to show its properties:—

- a. Soak a piece in water to show that it *will not dissolve*.
- b. Heat a small quantity to show that it *will melt*.
- c. Try to break a piece with a hammer to show *lack of brittleness*.
- d. Lead the children to observe its color, feeling, odor, and taste.

Could it be recognized by taste alone?
Does the bee collect wax or manufacture it?
What use does *man* make of beeswax?



DRONE.

4. **HONEY.**—Natural or manufactured product? qualities? how kept by bees? for what purpose? forms sold in market? different grades? uses man makes of it? meaning of

old, new, and candied honey? kinds of flowers made from? present retail price?

When these topics have been mastered, we may consider the —

BEE'S ENEMIES. — Moths; mice; king birds; toads; bears; ants; wasps; hornets; spiders.

Note. — The best book for thorough study on this subject is "The Honey-Bee," by Langstroth.



QUEEN CELLS.

There are many bee stories found in —
 Harper's Third Reader.
 Animal Life. *Bass.*
 Stickney's Third Reader.
 First Science Reader. *Nelson.*
 Seaside and Wayside. Vol. I.



QUEEN.

For language work while studying the whole subject, there are many pretty quotations, such as: —

"The bee from his industry in summer eats honey all winter."

"The careful insect midst his works, I view,
 Now from the flowers exhaust the fragrant dew,
 With golden treasures load his little thighs,
 And steer his distant journey through the skies.
 Some against drones the hive defend,
 Others with sweets the waxy cells distend,
 Each in his toil his destined office bears,
 And in the little bulk a mighty soul appears."

"The pedigree of honey does not concern the bee,
 A clover, any time, to him is aristocracy."

L. ZELLA STARKS.

THE bumblebee, with his fuzzy body and legs, is the best of mediums for carrying the fertilizing pollen from one blossom to another. Without the bumblebees the clover fields would be seedless; yet too often the farmers' boys are allowed to exterminate them,—one more instance of the farmer ignoring his best interests. The successful man must always know and appreciate his friends, and assist them in their efforts to aid him.—*Ex.*

THE OBJECT OF NATURE STUDY.

EVERY school that makes any pretensions to progress now has its course of instruction in nature study. It has become almost a fad, and is certainly an improvement on some of its predecessors. It had its beginning in what was called "object-teaching" a score of years ago. Twenty minutes in a day, or sometimes only once in the week, was devoted to a lesson on some material object. What the particular object was did not matter greatly. There was little or no attempt to establish any correlation between the object study and the pupil's other lessons, nor between one object-lesson and the next. Teachers appealed only to the child's senses for the moment, and perhaps often had less practical acquaintance with the qualities and uses of the objects than the children did.

But such pioneer work had its merits, and led the way to something better. Yet it was pioneer work only in a relative sense; more truly it looked centuries backward toward the pedagogy of the Great Teacher of Galilee. It was a feeble step toward a revival of the best method of teaching that the world ever knew. No one now doubts or denies that the nature study illustrated in the teaching of Jesus set the highest mark before the student. To commune with nature, to enter into the secret of her ways, to look "through nature up to nature's God,"—this is better than mere dissection and classification and laboratory courses, science stories, nature myths, and the whole *impedimenta* of our modern science education, if the ultimate *object* of the study is not discerned. The microscope and the retort and the blowpipe, all should make one a more discriminating student of nature. These should be used, not merely to make one wise,—to know things, conditions, relations, and general laws,—but to *know nature*. And her secret is with him who reverently listens to the voice of her Creator and Interpreter.

The nature study which falls short of recognizing God as its author,—not as an impersonal Law, but as a daily and divine Providence,—misses the ledge on which to hang the ladder that uplifts the student to a higher view of life and duty. F. W. H.

FLOWERS are the sweetest things that God ever made and forgot to put a soul into.

A man, in this world, is a boy, spelling in short syllables; but he will combine them in the next.

A helping word to one in trouble is often like a switch on a railroad track — but one inch between wreck and smooth-rolling prosperity.—*Beecher.*

Conducted by A. B. OLSEN, M. D., M. S.

HUMAN PHYSIOLOGY.

RESPIRATION.—CAPACITY OF THE LUNGS; COMPOSITION OF THE AIR.

THERE are two phases in every act of breathing. First, the chest expands and the lungs open. By this means the air is rarefied; that is, the pressure of the air in the lungs becomes less than the outside atmospheric pressure. Hence, the air rushes in until equilibrium is re-established. The breathing in of the air is called inspiration (from Latin *inspiro*, from *in*, in; and *spiro*, breathe). The second phase is characterized by a shrinkage of the lungs and a flattening of the chest. The contraction of the lungs increases the internal pressure of the air, thus causing it to rush out until equilibrium is again attained. This is known as expiration (from Latin *er*, out; and *spiro*, breathe).

Inspiration is a muscular act, and the muscles chiefly concerned in it are the diaphragm and the external intercostal muscles. On contracting, the diaphragm is flattened, thus increasing the vertical diameter of the thoracic cavity, and causing more or less protrusion of the abdomen. The contraction of the inspiratory intercostals raises the ribs and also partially rotates them outward, and thus increases the anteroposterior and lateral diameters of the body cavity. (Fig. 8.) A forced inspiration brings into action a larger number of muscles, such as the pectorals, serrati, etc.

Normally, expiration is a passive act. As soon as the inspiratory muscles cease to contract, relaxation follows and the parts return to their former position.

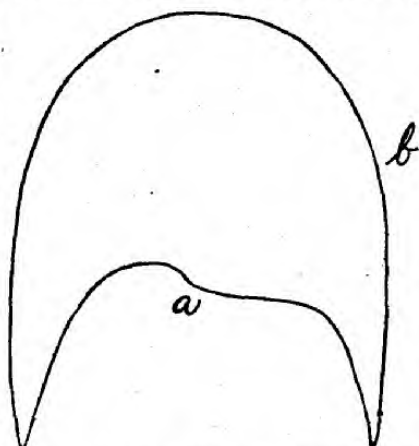


FIG. 8.—Diagram showing enlargement of the thoracic cavity in costo-abdominal breathing. *a* shows flattening of the diaphragm; *b*, the increase in the anteroposterior and lateral diameters.

The elasticity of the lungs is an important factor in bringing about their shrinkage, and thus driving the air out. On the

other hand, forced expiration is emphatically a muscular act. The internal intercostal muscles, and also the abdominal muscles, are brought into play. By means of the latter muscles the abdomen is compressed and the diaphragm forced upward.

As we have seen, then, breathing is accomplished by the action of the diaphragm and intercostal muscles, and hence two types of respiration may be distinguished, depending upon which muscle or muscles are chiefly used in inspiration. When the diaphragm is used principally, it is called diaphragmatic or abdominal breathing; but if the intercostal muscles, and especially the upper ones, are used mainly, we have the costal or thoracic type. This may be illustrated diagrammatically:—

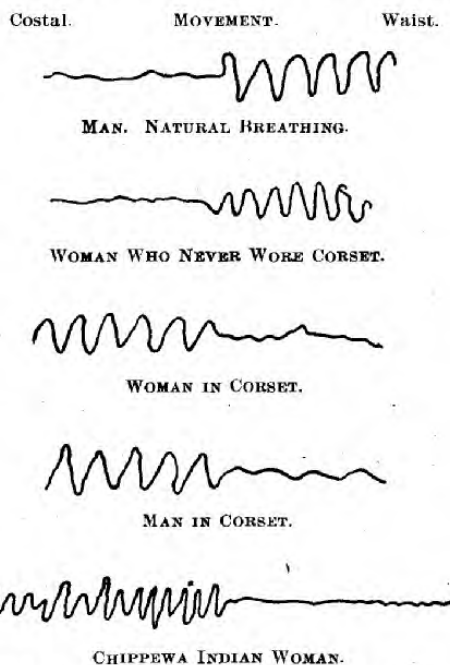


FIG. 9.—Breathing movements as registered by the pneumograph. (After Kellogg, "Second Book in Physiology.")

Women are generally said to use the costal type, and men the abdominal. But Dr. Kellogg has demonstrated the fallacy of this statement by an extended series of careful experiments and observations. He finds that only civilized women use merely the upper part of the lungs, and that this is due to their unnatural mode of dress, which makes it impossible for them to breathe properly. By means of the pneumograph he has made a large number of respiratory tracings, and found that

uncivilized women, such as Indians and Chinese, breathe the same as men. He also found that women who never deformed themselves by the use of a corset breathe normally. (Fig. 9.) Costo-abdominal breathing, that is, a proper combination of both types, is probably the natural method.

The amount of air inhaled in ordinary breathing is small compared with the total capacity of the lungs. It is usually about thirty cubic inches, and is called the tidal air. Complementary air is the quantity that can be taken in by a forced inspiration after breathing in the tidal air, and supplemental or reserve air is the amount that can be exhaled by a forced expiration after an ordinary expiration. Complementary air is estimated at one hundred and ten cubic inches, and supplemental at one hundred. Vital capacity, or the volume of air that can be breathed in after a forced expiration, or exhaled after a forced inspiration, is the sum of the three varieties, and on the average amounts to about two hundred and forty cubic inches. But a certain amount of air, usually one hundred cubic inches, remains in the lungs even after a forced expiration, and this is called residual air. This air together with the reserve air is called the stationary air, about

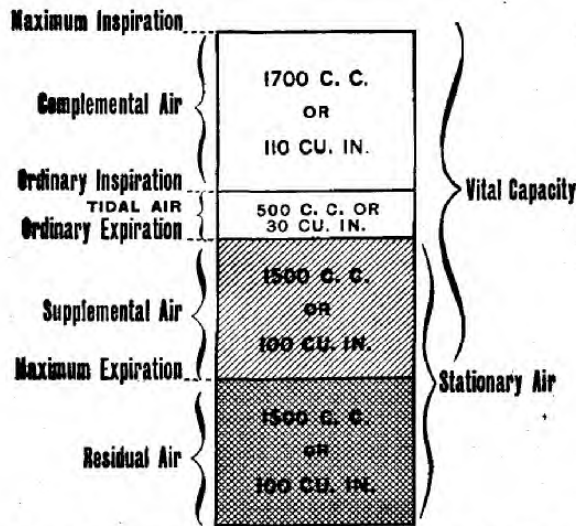


FIG. 10.—Diagram showing the amount of air in the lungs in different phases of respiration.

two hundred cubic inches. The total capacity of the lungs then, is about three hundred and forty cubic inches. (Fig. 10.) All the figures here given are for an average case, and hence are only approximately true of a given person. They are modified by age, size, occupation, physical vigor, etc.

The amount of air inhaled at a single breath depends principally upon the frequency of respira-

tion. Rapid breathing is usually shallow, and deep breathing relatively slow. In other words, doubling the rate does not double the amount of air respired. The rate depends upon the state of activity of the person. According to Guy, the average for healthy persons while lying down is thirteen respirations per minute, while sitting nineteen, and twenty-two while standing. In sleep one breathes about one fourth less frequently than during the day. Muscular activity always increases both rate and depth.

It is interesting to note, in passing, that the rate is slightly less, about one degree, in the morning than in the evening; about thirty-two per cent. greater in the spring than at the end of summer [E. Smith]; and that it may be greatly affected by the emotions and will. Great changes in atmospheric pressure affect the rate inversely, for the rate falls when the pressure rises.¹

The maximum vital capacity is reached at the age of thirty-five, or what is known as the "prime of life." Up to that time it is constantly increasing with a decreased ratio of respiration. In later life there is a slow, gradual decrease both in ratio and capacity. The vital capacity of women is less than that of men,—a ratio of about seven to ten, according to the best statistics.

The influence of occupation is important. Those who live largely out-of-doors, breathe the fresh air, and do a large amount of hard physical work, have a greater vital capacity. Scientific investigation shows that soldiers and sailors head the list, then come the day laborers, and last of all students, officials, and paupers.

The vital capacity of an individual may be readily measured by means of a simple apparatus devised by Hutchinson. [Fig. 11.] It is called a spirometer (from the Latin *spiro*, breathe, and *metrum*, measure). It consists of a graduated cylinder immersed in a vessel full of water. The expired air is conducted into the inner cylinder, which rises as the water is displaced by the air. The total amount is shown by the indicator.

The composition of pure air is very simple. According to Foster, inspired air is composed of—

Nitrogen	79.15 vol. per cent.
Oxygen	20.81 " " "
Carbolic acid gas.....	0.04 " " "

About one per cent. of the amount allowed for the nitrogen consists of argon, a gas recently discovered. Nitrogen and argon are both inert and serve to dilute the oxygen, which is the essential constituent. Carbon dioxide is the deleterious

¹See "American Text-Book of Physiology," pages 533 and 534.

component, and may well serve to measure the degree of impurity of the air.

Such ought to be the composition of the air we breathe, but it is often anything but pure and fresh, being continually contaminated by the exhalations of man and beast; and were it not for a wonderful provision of nature, it would soon become a deadly poison. Parallel with the contaminating influence of animals is found the purifying processes of plants, by means of which the CO_2 is withdrawn and oxygen restored.

But CO_2 is by no means the most fatal constituent of air. There are certain organic substances which have been well designated as "crowd-poison," and which, although present only in small quantities, are exceedingly harmful. They may be considered as the result of tissue waste of the body, and very soon render the air "close" and "fusty," as we say. It is practically impossible to measure these foul poisons quantitatively, but it is found by observation that they vary directly with the amount of CO_2 present.

Expired air is laden with organic impurities, and furthermore has lost about one fourth of its oxygen. Quoting again from Foster, the exhaled air is found to contain—

Nitrogen.....	79.587	vol. per cent.
Oxygen.....	16.033	" " "
Carbonic acid gas (CO_2).....	4.38	" " "
Also watery vapor.		

From this table we see that the used air contains more than one hundred times as much CO_2 as the inspired breath. Again, it is saturated with watery vapor and warmed. The warmth causes it to expand and rise, thus giving place to the colder fresh air.

As we have already indicated, the expired air is more or less saturated with organic effete matter, tissue wastes, which are produced by the disintegrative or breaking-down processes of the body. All the muscles of the body and all other structures give off organic wastes, and it is very important that they should be eliminated as soon as possible. If they are allowed to accumulate in the body even for a short time, death results. For when a person dies from strangulation or asphyxia, it is not primarily from a lack of oxygen, but rather on account of the heaping up in the body of organic poisons.

The "respiratory quotient" is the ratio of the relative amount of oxygen absorbed, and of CO_2 eliminated. It varies with different animals, and in the same animals at different times. It is the

quotient obtained by dividing the quantity of CO_2 eliminated, by the amount of oxygen taken up; thus, $(\text{CO}_2 4.34) \div (\text{O}_2 4.78) = 0.908$. In other words, 0.908 of a volume of CO_2 is restored to the air for each volume of oxygen lost.

According to Valentine, the average amount of watery vapor lost per diem is about five hundred and forty grams. Vierordt gives only three hundred and thirty grams. Of course the quantity given off bears an inverse ratio to the degree of saturation of the atmosphere and the activity of respiration. On

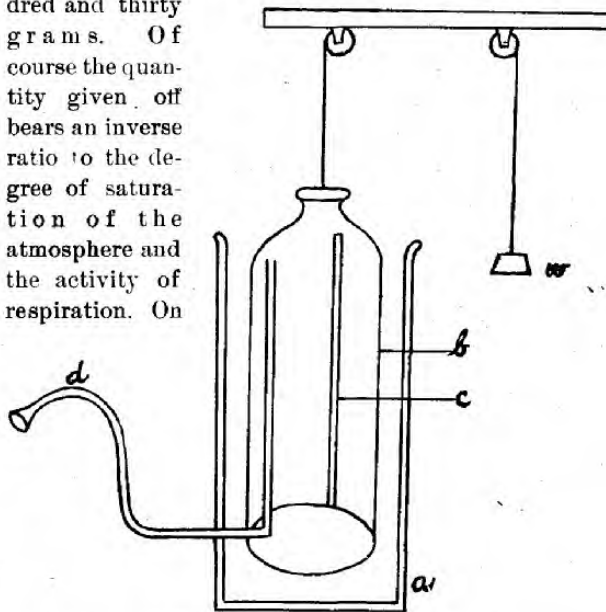


FIG. 11.—DIAGRAM OF SPIROMETER.

a, vessel filled with water; b, cylinder with scale; c, d, breathing tube; w, counterpoising weight on pulleys.

account of its increased temperature the volume of the expired air is slightly increased, usually about ten per cent.

[The Spirometer illustrated above can be easily made for any school by using a pail for a and a large jar for b. The tube d may be of rubber and pass over the top edge of the pail instead of through its side, the lower end being held down under the bottom of b by a small weight tied around it. The scale should show cubic inches. (It will be a good problem to calculate this according to the diameter of b.) Try this, and report results to the EDUCATOR, being careful not to blow it too hard. — Ed.]

THE penetrating power of the solar heat ray is very well illustrated in the elliptical movement of the top of the Bunker Hill Monument. The monument, an obelisk of granite 221 feet high, moves at the top so as to describe an ellipse following the sun's rays. This movement commences about 7 A. M., of a sunny day, and has its maximum in the afternoon. In a cloudy day, no motion exists, and a shower restores the shaft to its normal position of stability.

Cleveland Farm School. — Ex-President Cleveland has given one hundred acres of land near Princeton to be used as a farm school for boys. It will be divided into four farms of twenty-five acres each, and one boy will be assigned to each acre. The object is to make the right kind of boys self-supporting, and give education and employment to the largest number possible of this class.

Hawaiian Schools. — It is said that a native Hawaiian is rarely found who can not read and write in his own language. Every village has its school, open seven months in the year. The percentage of illiteracy is less than in some of the States already in the Union. Reading circles have been established in all the principal islands of the group, and a summer school for teachers is held annually in Honolulu.

"United States of Central America" is the title of a new republic formed by the union of the States of Nicaragua, Salvador, and Honduras. The legislative assembly in each, which has formerly been called the congress, will now be known as the legislature, and the former presidents will now be governors. Each State reserves the right to manage its own internal affairs, but merges its independent nationality in the new general government.

The Trans-Mississippi Exposition at Omaha, Neb., closed on October 31. It has been a success financially. The receipts amounted to nearly \$2,000,000, and the expenditures to \$1,450,000. Nearly 3,000,000 people visited the exposition. The enterprise will probably be continued in some form next year, the most popular idea being to make it a colonial exposition, in which the products of the colonies acquired in the Spanish war may be exhibited.

The "Black Death." — The people of Vienna, Austria, are dreading a visitation of the bubonic plague. Dr. Mueller, a celebrated bacteriologist, recently returned from Bombay, where he studied the plague, and brought back some of its bacilli. These were cultivated, and experiments were carried on with the purpose of obtaining a serum with

which to inoculate against the plague. Dr. Mueller has died of the malady, and one of his assistants named Barisch. Several others are stricken with the disease, and have been strictly quarantined. Great alarm is felt lest the plague extend throughout the city. Europe is by no means a stranger to this "Black Death." Historic visitations of this scourge to European cities, with their resulting fatalities, have been as follows: Venice, A. D., 1528, 100,000; Florence, 1328, 60,000; Marseilles, 1720, 60,000; Moscow was nearly depopulated in the year 1730. In 1328 England was visited by the plague, and fully one third of the population perished. Toward the end of the eighteenth century, Egypt and Morocco lost more than 1,000,000.

Some Recent Events. — Sir Herbert Kitchener has been appointed governor of the Soudan. — It is reported that Dreyfus is on his way to Paris, to attend the revision of his trial. — The outbreak of Pillager Indians near Leech Lake, Minn., has been subdued. — It is reported that Lieutenant Hobson has advised the U. S. Government to abandon the attempt to raise the "Cristóbal Colon" and the "Vizeaya" by contract work. — The Filipinos have celebrated a declaration of independence. — Liberia has sent an agent to the U. S. Government requesting it to assume a protectorate over the African republic, in order to prevent encroachment from European powers. — It is reported that the American Peace Commissioners have demanded the cession of all the Philippines with part of their debts. The Spanish Commissioners threaten to break off negotiations and appeal to the powers for protection. — President McKinley received the honorary degree of Doctor of Laws from the University of Chicago during his recent visit on October 17. — Porto Rico has been entirely evacuated by the Spanish. — The President has issued an ultimatum that the army of Spain must quit Cuba before Jan. 1, 1899. — The "Maria Teresa," recently raised by Lieutenant Hobson, was abandoned in a storm while being towed to Hampton Roads. She may yet be saved. — Fashoda is to be surrendered unconditionally to England. — Joseph Leiter has undertaken to revive the manufacture of locomotives in the abandoned works near Providence, R. I. — A San Francisco wrecking company has offered to raise the "Maine" without compensation unless successful.

THE FIELD OF EDUCATION.

SOME months ago the EDUCATOR presented for discussion a suggested "Course of Study for the Christian College." It elicited much favorable comment, and the criticisms received upon it warrant a further presentation of the subject. But any course of study presupposes some philosophy of education; that is, some ideal to be attained and the means for its development. The best educational ideal is one that is based upon the nature and needs of the subject to be educated. And the best philosophy of education is that which comprehends all the conditions, manifestations, and relations of the human being. To revert to a definition already used (page 71), "Education is a preparation of man's physical, mental, and moral powers for the best performance of all the duties of life."

This threefold classification is to be considered at length in the series of articles on "Bible Psychology." It is doubtless capable of graphic illustration. An attempt in this direction is shown in the diagram on the next page, which is submitted for criticism.

A few explanations are given concerning certain terms used in the diagram that might otherwise be misunderstood. "The Individual" is, of course, the *Ego* as subject,—the being to be educated in his physical, mental, and moral attributes. "Individual" is used rather than "Self" to avoid repetition of the latter term in its objective sense under "Things." "Physiology" as here used is the broad, general category which includes all the physical conditions and forms of life. The term "Biology" has sometimes been employed in this sense, but latterly has acquired the more specific meaning of Botany and Zoology. Authorities could be given for the use of both "Physiology" and "Biology" as here employed. "The Sciences" is used collectively; it might be qualified by the terms Exact, Physical, Natural, etc., according to specific cases.

As all the manifestations of the Self's activity originate in the mind, and hence are essentially mental or psychical, the term "Psychology" is used in the broad sense that is illustrated in the use of the term "Physiology," and is co-ordinate with the latter, as "The Arts" are with "The Sciences."

The primary subdivisions of "Psychology" as here given do not exactly coincide with those indicated in the books. In fact, there are scarcely two "authorities" who agree in psychological classification. But if "Feeling" is understood to include not only

the activities of the special senses but also the passive emotions (pleasure, sorrow, etc.), and "Acting" is understood to embrace the active emotions (anger, mirth, etc.), while "Wishing" includes the appetites and passions, it will be seen that these seven categories may embrace all mental phenomena. "Reflection" is used in preference to the more technical term Apperception, which is employed by some psychologists to indicate the total elaborative process by which each new idea becomes incorporated and organized in the storehouse of the mind. "Language" is used in the broad sense that embraces all the activities that stand between "Thought" and "History."

"Ethics" includes all the moral relations of "The Individual" to "Things," to "Man" in general, and to the Deity. The "Self" is one's own individuality as an object of care and responsibility, or "Stewardship." "Nature" is the realm of inanimate things and animals over which dominion was given to man. And the purpose of this relation is "Discipline." The virtue to be exercised toward other human beings, either in the "Family" or the "State" is "Fraternity," and toward God is "Worship." "Church" is used in the broad sense as including all those relations of man to God that are implied in "Religion,"—"Faith, Hope, and Love." All the Ethical relations are governed by, and comprehended in, "Law,"—in the broad sense that is neither "Art" nor "Science," but which unifies the whole development of man under the discerning eye of "Philosophy." And Philosophy in this sense opens "The Universe" to "The Individual." The whole diagram may be read forward or backward, according as we proceed centrifugally from the individual to the universe or centripetally from the universe to the individual.

It is earnestly desired to perfect this diagram with the help of suggestions from EDUCATOR readers; and then to use it as a basis for further investigation in the development of the subject begun in "Bible Psychology." Please regard this as a personal request. The EDUCATOR likes to come into close quarters with its friends, to give and get for mutual advantage. Send in your suggestions with your name for membership in "The Christian Educators' Association" (no fee) for the study of such subjects as here proposed. Another copy of this (November) magazine will be sent free to any one who will return these pages with notes, corrections, or comments. Please note also our special announcements on the next two pages.

PUBLISHERS' DEPARTMENT.

BOOK NOTICES.

We notice that Professor Bell's article, "Good English: What Is It?" which appeared in our May number, is quoted entire in the *School Record* for September. Professor Bell is the author of a complete series of text-books that tell how to teach good English in the best way. It is known as BELL'S LANGUAGE SERIES, and consists of five books of 270, 225, 275, 370, and 600 pages, respectively, under the following titles: *Primary Language Lessons*, *Elementary Grammar*, *Complete Grammar*, *Rhetoric*, and *Studies in English and American Literature*. While the series is interdependent throughout, each book except the first and last embraces an incidental review of the preceding book. Each may thus be used independently for private study or in school grades that are preceded or followed by other books. This series is a complete revision and expansion of Professor Bell's "Natural Method in English," which was one of the earliest American language text-books based on the rational method of learning by do-

ing. It has had many imitators. A special feature of the series is in using for examples matter that is intrinsically worth reading and learning. These are carefully selected with reference to co-ordinate studies, and with the view of forming and educating the pupil's taste for the lasting and beautiful in literature. The last volume "is not so much a study of the authors as of their writings. It is intended as a study of literature rather than of literary people, and is based upon the conviction that a constant association with noble thoughts and pure expression will improve both mind and speech if it can be done by any means at our command."

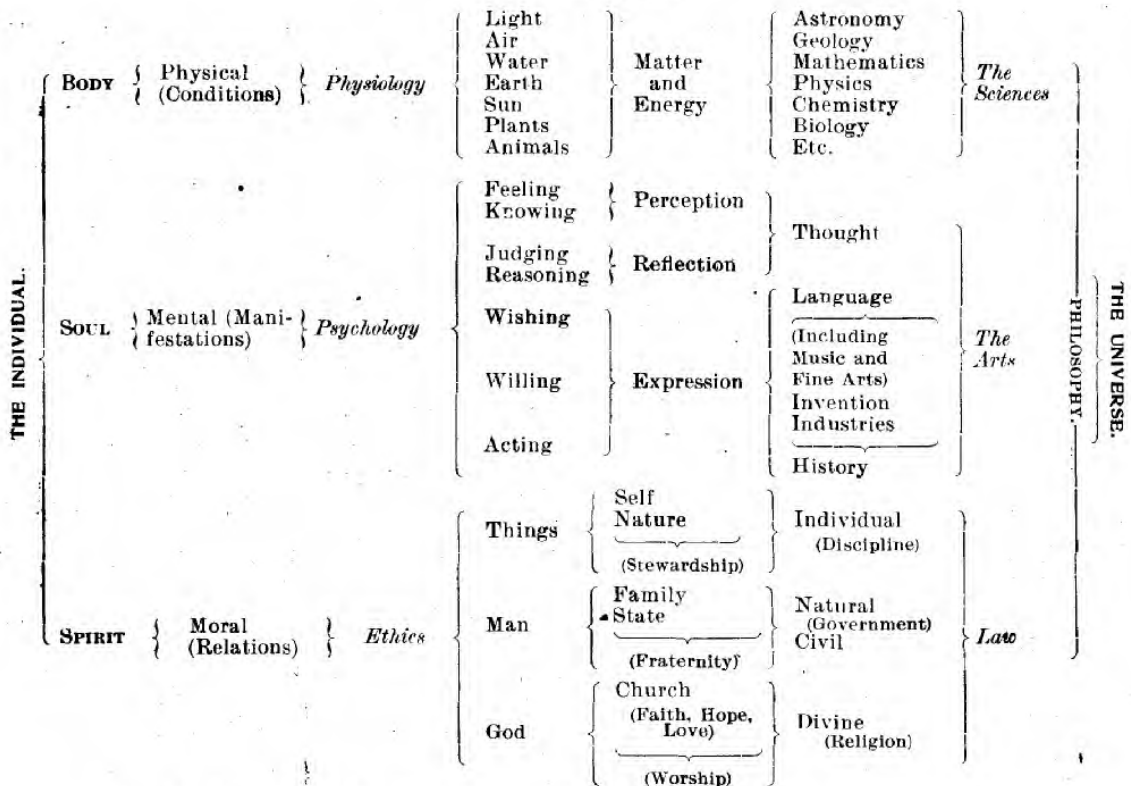
The whole set constitutes the best series on English with which we are acquainted. *Review and Herald Publishing Co.*

ANYTHING that is of practical benefit to mothers' clubs is, in this day and age, very welcome. The *Mothers' Club Helper*, issued monthly by the Wood-Allen Publishing Company, Ann Arbor,

Mich., is a very helpful leaflet. It contains a well-directed series of questions upon the topics presented by the course of study, designates home readings, and presents a complete program for each meeting. It is the only complete guide for mothers' clubs yet published. Price, 35c per copy for one year, lower rates in clubs.

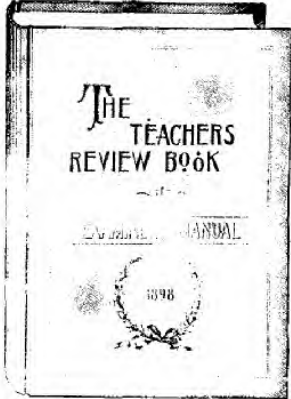
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[See preceding page.]



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SOME NOTICES.

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