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The Canada School Journal.

AND WEEKLY REVIEW.

VOL. X. TORONTO, SEPT. 10, 1885. No 32.

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The Canada School Journal and Weekly Review.

An Educational Journal devoted to the advancement of Literature, Science, and the teaching profession in Canada.

—o—TERMS.—o—

THE SUBSCRIPTION price for THE CANADA SCHOOL JOURNAL is $2.00 per annum, *strictly in advance.*

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Publishers.

The World.

The Young Men's Liberal Club of Toronto is just now receiving a flattering amount of public attention. The idea seems to be rife that at the approaching meeting some bold, almost revolutionary, course will be adopted and sanctioned. The proposal in favour of a custom's union with the United States which, it is understood, is likely to be made a plank in their platform, is itself a startling one. Such an arrangement, should it prove feasible, could scarcely fail to give a great impulse to Canadian progress.

Shall Riel's sentence be carried out, is just now the foremost question in political circles in Canada. It is positively painful to see such a question, involving the life of a fellow-being, made the foot ball of party spirit, and debated on the low ground of political expediency. It seems clear that if the man is hanged, he will be hanged because that is considered best for the party, and if he is reprieved, or has his sentence mitigated, it will be for the same reason. It is a bad state of affairs when all important public matters, even those involving life, are discussed and decided not in the light of great, fundamental principles, but with a view to political effect.

Mr. Parnell has caused a good deal of excitement in political circles in England by recent speeches, in which he is represented as declaring that Ireland wanted independence and would accept nothing less, and that it was the intention of himself and his followers to render parliamentary legislation impossible until this was conceded. We cannot but think his meaning must have been in some way misunderstood, or misrepresented, as he must know that such a demand would be hopeless and would make both political parties a unit in their refusal. Meanwhile the statement of this attitude on his part has had the effect of a bomb shell in both political camps. Lord Hartington, the Whig leader, boldy declares it out of the question. The justice of Home Rule is now within reach of the Irish people and it would be a suicidal policy on their part to spurn it and reach after the unattainable.

The new-born colonizing mania of the Great European Powers may, perhaps, be of good omen in one respect. It seems prophetic of a speedier civilization of the world. But it is, on the other hand, full of menace to the peace of Europe And, surely, it is humiliating so near the close of this boastful century to see the foremost Christian nations engaged in a game of grab for the birtarights of the uncivilized tribes, for purposes not of benevolence but of self-aggrandizement. The latest instance is the seizure by Germany, of the Caroline Islands, long nominally at least appendages of Spain. The insignificance of the islands themselves serves but to heighten the turpitude of the uncalled-for aggression. These little islands may be found by careful search in a good map, almost hidden in the bosom of the great Pacific. The total area is given in some of the Cyclopædias at 872 square miles. They have always been claimed by Spain, as a part of the Phillipines to which they are adjacent. What ulterior purpose the "man of blood and iron" has to serve by annexing them does not yet appear, but it would be inconsistent with all Bismarck's record to suppose that the game is for no richer prize than the insignificant islands themselves.

The School.

We have during the last few weeks received from subscribers an unusual number of complaints of irregularity in the arrival of the JOURNAL. Some of these apparent irregularities are explained by the fact that during the holiday months (July and August) the paper was issued only on alternate weeks. Our announcement in regard to this seems to have been overlooked by some. But in many other cases we are quite unable to explain the non-appearance of the JOURNAL, which is carefully mailed to all subscribers. In one instance, the week before last, the issue was unfortunately delayed for several days, owing to a combination of causes, one of which was a breakage in the press-room, which made it necessary to send the paper to

another office to be printed. Any failure of the paper to reach subscribers in time is a matter of annoyance and regret to us as well as to them and we promise to do our best to render them as few and far between as possible.

Mr. Glashan's paper on Science in the Schools, given in our last issue, is worthy of the careful perusal of every teacher. It will be seen that Mr. Glashan does not mean by the teaching of Science simply the manipulation of chemical agents in a few curious experiments, much less the study of dry formulas and complicated classifications, or conjuring with Latin or Greek compounds a foot and a half long. There can be no longer a doubt that the study of science proper has a true educational value equal to that of any other branch of learning. It has moreover, this distinctive merit, that while it strengthens the powers of reasoning, abstraction and generalization equally with almost any other branch of study, it is eminently adapted to quicken those perceptive faculties which minister so largely to both pleasure and profit in every sphere of life, and which the exclusive study of language or mathematics tends to blunt rather than sharpen, by disuse. We are by no means of the number of those who would have the new science cast out and supersede the old classics and philosophy, but we cannot doubt it has made good its claim to stand side by side with any of them. The extravagant demands of some of its enthusiastic votaries have perhaps retarded rather than helped recognition of its real merits, but the time has fully come when science should take in every school and college curriculum the prominent place claimed for it by competent and moderate advocates, such as Mr. Glashan.

All indications seem to point to a great and swift development of the technical school idea. Schools and colleges based upon this idea are multiplying in the United States and Great Britain. The *School Guardian*, in a late number, chronicles the completion of the Merchant Venturers' School at Bristol, one of the most extensive institutions yet established for the purposes indicated. This school replaces the British Trade School, which was itself a great success, giving instruction to 500 boys. But "on the recent agitation in favour of Technical Schools," says the *Guardian*, "it occurred to the wealthy guild of Merchant Venturers that it would be a good use of their money to erect a building worthy of their city and to endow and furnish it on a large and liberal scale. This they have done. There is accommodation for 900 students, with everything in the way of lecture-rooms, laboratory, museum, and other appliances, that the best institutions of this kind seem to require. Having erected the splendid building on the site of the old Grammar School, at a cost of £50,000, the Merchant Venturers generously handed it over to the corporation complete in all its equipment, and prepared to do a noble work for the industrial and commercial classes of the West of England. In this way we are growing rich in institutions of the nineteenth century, which may reasonably be expected to confer immense benefits upon the ages yet to come."

Colonel Carrol D. Wright, Chief of the Massachusetts Bureau of Statistics and Labour, devotes sixty pages of his last annual report to facts bearing mainly upon the effects of study and college life upon female graduates. From answers given by eleven colleges to questions asked, Col Wright concludes that the female graduates of American Colleges and Universities do not show any marked difference in their general health from the average of women engaged in other kinds of work, or from women generally. This will surprise few. The chief matter for surprise is that statistics should be needed to prove that brain work, which in itself, within reasonable limits, has been proved to be conducive to longevity rather than the opposite in men, should be injurious to women. Were the latter found to exhibit less power of endurance in ordinary life than the former, there might have been ground for such an inquiry. But the fact is we believe that the average woman works harder, for longer hours and endures more nervous strain and more fatigue of body and brain than the average man.

THE NEW REGULATIONS.

In our news columns will be found this week that portion of the new Regulations of the Department which contains the course of study laid down for High Schools and Collegiate Institutes. Next week we will give the requirements for teachers certificates, non-professional and professional. The assimilation of these requirements with the matriculation work of the High Schools will greatly simplify the programmes of these schools and lessen the difficulties of Head Masters. It will also pave the way to the University for many teachers, and no doubt an increasing number of the more ambitious of these will be found taking a full or partial University course. This will be a good thing for the teachers themselves and for the country. Whether it will be a good thing for the Public Schools will depend mainly upon the ability of the School Boards to retain such graduates in the profession. This again will depend largely upon the liberality of the parents and other contributors to the school funds. We hold it to be easily demonstrable, if not axiomatic, that, other things being equal, the more thorough the education of the teacher the better work will he be able to do in the instruction of even the youngest pupil. If a Master of Arts does not understand both the workings of the child-mind in general, and the idiosyncracies of the individual mind with which he has to deal, far better than the average teacher whose opportunities have been limited strictly to the course prescribed for his certificate can possibly do, then there is no virtue in intellectual training and no value in education *per se*. We premise, be it observed, "other things being equal." The fact of course is that other things are often not equal. Many a second or even third class teacher may be a more successful educator of the young than many a University graduate. This only proves that the former possesses natural qualifications denied to the latter, and affords an additional reason why the former should, if possible, secure all the benefits of thorough collegiate training. We believe the day will come, though we may not hope to see it, when the equivalent of an arts course will be required of every teacher in the

Public Schools, but a great advance in remuneration and other marks of appreciation of the teachers' high calling will have to be made before that happy day can arrive.

The provision that a degree in Arts with honours in one department may be accepted in lieu of a first certificate of the highest grade is reasonable and wise, as is also the awarding of a diploma by the Education Department to all who pass the examinations in any of the courses prescribed. We do not attach so much value to the introduction of a commercial course, as to the provision for the study of Agricultural Chemistry. If either were to be left optional it should have been the former, rather than the latter. Education by the State at public expense can be justified only as it can be shown to be essential to the welfare of the State, *i. e.*, of the whole people One of the greatest hindrances to prosperity in this Western world is the forsaking of the country for the town, or city. On every hand the young men are abandoning the grand independence and sure competence of the farm, for the abounding hazards and scanty rewards of the office or counter. Nowhere can this mischievous tendency be counteracted so effectively as in the Public Schools. Special prominence should be given in these to those subjects which tend to foster a taste for rural life and agricultural and horticultural pursuits. The scientific inventor is doing much to lessen the severity of the farmer's toil, and increase its productiveness. The scientific teacher should do much to enhance the attractiveness of agricultural pursuits, by enlarging the intelligence of the coming farmers and elevating the general conception of the dignity of their calling. Agricultural Science should be taught, in the most practical manner possible, at least in every country school in in the Province.

Special Articles.

EDUCATION IN REFERENCE TO CHARACTER.

Mr. President and Members of the Ontario Teachers' Association:

I must confess to some amount of hesitation in accepting the invitation of your secretary to read a paper before this association. Whilst profoundly grateful for the honor you have thus done me, I felt strongly that one comparatively unacquainted with the detail of the Ontario system of education, had little right to read a paper before an assemblage such as this, composed of gentlemen whose whole lives are devoted to the working out and the improvement of that system. I was led, therefore, to select a subject bearing upon education in general, viz.: its influence upon the formation of character, and I must crave your kind indulgence if, in treating of a somewhat well-worn, yet, I venture to think, most important subject, I, of necessity, suggest thoughts familiar to you in your own educational experience, as also for the somewhat fragmentary way in which, from the pressure of varied engagements, I have been compelled to discuss the subject.

According to one numerous and influential school, the office of education is not so much to develop character as to procure for it in the future an environment at least relatively favorable to that development. It has been urged that the chief dangers to the social order arise from the hard pressure of poverty and want. By the diffusion of knowledge, especially of a technical or scientific character, it should be the aim of education to increase the power of the individual, and thus to raise him above the stratum of temptation in which the lot of poorly remunerative labor is inevitably cast. Now, whatever partial truth there undoubtedly is in the contention, it cannot be denied that the optimistic views founded upon it, and largely current a generation ago, as to the solvent effect of education upon crime, have not been confirmed by experience. Instead of melting away under the gentle influence of knowledge, crime has largely increased. If we flatter ourselves that it has at least become more refined, we are startled from time to time by the revelation of the grossest crime, rampant amongst educated men. Fraud and dishonesty threaten to invade with overwhelming force every class and every occupation; and there seems to me no small peril that, in disgust at the utter failure of unreasonable expectations, education may, in the not distant future, be unduly discredited for an issue which might from the first have been clearly foreseen.

The primal fallacy underlying this whole position is the assumption that any condition of life is comparatively free from temptation, so that by increasing the power of an individual we enable him to rise to any great extent above its influence. On the contrary, the truth seems to be that with the increased power which education brings, as well as with that which multiplied invention, rapid communication and locomotion has supplied, temptations dangerous to society have become far more intense as the chances of success, as well as the prizes to be obtained, have been proportionately greater. To quote a recent writer in the *Century*:—"The greater temptations of the present day demand greater conscientiousness to resist them, and this greater conscientiousness is not always forthcoming."

Experience is every day demonstrating with increasing force, that if education has no other ameliorating influences at her command than the mere negative one of improved material surroundings, then the outlook for society is undoubtedly dark, and the results of the teacher's work hopelessly unsatisfying. It is the deep conviction of the present writer that only by recognizing and fostering the *direct influence* of education upon *character* can an adequate remedy be found—whilst from this influence rightly exercised the best results may under the Divine blessing be expected. The subject is at least a practical one, and it may be that the present time is not unsuitable for its discussion. A moment's reflection seems sufficient to prove that the direct influence of school life upon after character must be unquestionably great. Whether we consider the receptive nature of the young life, or the fact that school forms a boy's first introduction to that wider social life which lies outside the family circle, and that therefore at school the foundation of those social virtues which regulate the intercourse of man with man will be laid, or necessarily the seeds of the opposite vices will be sown; if we consider further that school introduces a boy into the conscious work of life, and that the spirit with which he addresses himself to his school work will, in the majority of cases, stick to him through life, and though little stress be laid upon the direct bearing of mental conceptions and bias upon the moral and spiritual character, it is clear that as he passes through the microcosm of school life, the boy becomes for the most part the father of the man.

Regarding education, then, not as the mere mechanical receiving of knowledge with a view to increasing individual power for the purpose of acquiring wealth, but rather as the living development and training of the manifold faculties and powers which each man possesses latent within him, the studies which are most fruitful for this purpose are undoubtedly those which are directed towards the past, such as literary, historical, classical studies, and the like, rather than those directed immediately to the needs of the present, such as technical, professional, and, to a large extent also, scientific studies, although in this last case such studies as actually bring the pupil face to face with Nature, and not with mere dogmatic state-

ments about her laws and methods, may exercise a deep and lasting influence upon character. This distinction has been ably drawn in a paper read before the present meeting of the association, so that it is altogether unnecessary for me to further develop it. A single practical suggestion only I throw out in illustration, viz., with regard to the strengthening of the powers of observation, and therefore of the capacity for the enjoyment of Nature, and of reverent fellowship with her, which can be effected outside the walls of the school. A botanical excursion, or vivid explanation of the way in which geologically the various features of some landscape actually in sight have been formed, may open up in the mind new interests and ideas to be gladly followed up in after life. This method of teaching by occasional excursions is strongly recommended by Milton in his Tractate on Education, and practised to a considerable extent in Germany. The successful introduction of Arbor Day, through the wise foresight of the Minister of Education, proves the possibility of such occasional lessons in Nature. To return, however; without underrating for one moment the practical importance of Modern Languages, it is undoubtedly to the thought and history of the ancient world that we must turn for educational influences of the highest kind. Acquaintance with French and German literature can no more equal in educational value living contact with the thought and motives of the ancient world than a tour in our own fair Province can supply the advantages of extended travel. I trust that I shall not be misunderstood as detracting from the great practical utility, and therefore importance, of the modern languages. It is unnecessary at the present day to plead for what is universally accepted. I speak only of their value for purpose of education in the strict sense of the term. It is, of course, a truism to assert that our modern thought and existing society have been profoundly influenced in every part by the three great streams of culture we inherit from the Greek, the Roman, and the Jew. To gain, however, any real insight into the nature of this influence—to see how the self-culture and analysis of the Greek, the consecration to law and the orderly discharge of the duties of citizenship which forms the distinguishing characteristic of Rome, the revelation of man's capacity for fellowship with God, and for co-operating with him for the building up on earth of a divine kingdom, which is the special dignity of the Jew, formed three indispensable factors in the necessary education of the race in its duties to self, to society, and to God; further, to gain even a faint glimpse of the way in which the mingled waters of these three streams flow on together in the Christian culture of to-day, because they have been united and harmonized in the person and influence of the perfect Man, is to gain an insight into the divine plan on which the education of the race has actually been based, the educational value of which can hardly be over-estimated.

I would not be supposed for one moment to undervalue the importance of the advance which has been made by the great improvement made of recent years in the various departments of professional and technical training. In this way has been rolled back a reproach often too justly levelled against our educational systems, that they failed to qualify their students for the actual occupation in which they were to engage. To fit men to discharge in the best and most efficient manner the various duties which devolve upon them is a side of education the neglect of which brings swift retribution with it. So far from minimising, I would strongly advocate the increase of these practical subjects of training; such subjects as book-keeping, hygiene, and the elements of sanitary science, the practical application of chemistry, and, for girls, domestic economy in its various departments, appear to be eminently deserving of more systematic treatment than they yet have received. I simply claim that such subjects do not exert the same influence upon character as is done by classical, historical, and scriptural studies, whose foundations lie deep down in the past development of the race: and that the development of character is a part of education of vital importance to the well-being of society. The true strength of a state undoubtedly lies in the character of its citizens, or, to quote the *Century* once more: "The prime cause of commercial dishonesty and political corruption is a false ideal of life; an ideal that puts the material interests of man above the spiritual, and makes riches the supreme effort of human endeavor, and the only efficient remedy is the establishment of a higher and more spiritual ideal." Such an ideal it is the function of education in its widest and most comprehensive sense to give, and I trust that the several types of education may be so harmoniously blended in our Ontario system that we may lead the van of progress towards this great and all-important end.

The treatment of my subject would hardly be complete without a few thoughts, however fragmentary, upon the direct bearing upon character for good or evil of the actual methods of imparting knowledge. The qualities which it is specially given to school life to develop are, I suppose, courtesy, fidelity and thoroughness in work, truthfulness and integrity, together with reverence for all that is really deserving of its bestowal. The grand old adage, *maxima puero debetur reverentia*, which even the most degraded of men in some sort recognize, recalls the fact that the personal character of the teacher or teachers will largely reproduce itself in such matters amongst the pupils. A thoroughly enthusiastic teacher, who is scrupulously conscientious about his own preparation, will become a very fountain of energy to dissipate that mental apathy of which boy-nature is often painfully conscious, and against which it often struggles manfully to but little purpose. Youth responds eagerly to enthusiasm, and the fact is worth remembering. It is impossible to exaggerate the importance of the bearing upon character of thoroughness and freshness in methods of teaching, together with every precaution for absolute integrity and impartiality in all matters affecting examinations, etc. Even trifling carelessness in such matters is like the opening of a sluice-gate, and sets free a torrent which it may be next to impossible to stem. For example, the boy who crams up by rote the translation of a Greek or Latin author, and succeeds in imposing upon an examiner thereby, has received a lesson in dishonesty which it will be well for society and himself if he does not afterwards turn to further account.

One element for which sufficient allowance is perhaps not always made in regard to its tendency to foster carelessness in work is the necessary ignorance of scholars either as to the nature or the importance of the subjects which they are required to study. A short explanation with reference to these points before beginning a new subject, especially if it be well illustrated with a few striking examples, may do much good; *e.g.*, if in beginning a classical author a few extracts in some good translation illustrating the most important features in the book were read to the class, their interest would be aroused and quickened. And again, in beginning Euclid, instead of allowing a child to flounder hopelessly by himself amidst the maze of definitions, postulates, and axioms, or to sink amid the difficulties of the *pons asinorum*, the attention of the class was called to the great practical utility of being able to construct accurately certain figures, *e.g.*, by the aid of a pair of compasses, to trace out on a board an equilateral triangle, etc., and the scholars are encouraged to attempt in various ways to solve a problem apparently so easy, an insight into the marvels of Plane Geometry will be gained, which will go far to surmount later perplexities. It is, perhaps, hardly too much to say that children should never be sent to the dry pages of a book to make out for themselves some new object of study—the living voice of the teacher with a bright,

cheery method of explanation being an aid to which children are really entitled in meeting new and unknown difficulties. Hunting out together in class the number of aorists, perfects, imperfects, etc., in a given passage is often a pleasant relaxation from the actual head work of memorizing or repetition.

Irreverence and flippancy in all its forms should be strictly discouraged, as the uniform index of a shallow mind, and the cloak of ignorance vaunting itself beneath a fancied and fictitious superiority. The law holds good in every department of knowledge that great thinkers receive back the instinctive reverence of childhood, only deepened and intensified by the manifold experience of varied knowledge. Thus we are led into the development of that reverence for purity, for holiness, for God, which is the crown and stay of human character. After the brilliant and exhaustive way in which the subject was treated from the presidential chair of this association by Mr. Archibald MacMurchy some two years ago, and the emphatic action taken by the association thereon, in advocating the efficient use of the Bible in schools, as well as that of smaller associations of teachers in various parts of the Province, it will be quite unnecessary for me to dwell upon the supreme importance of Bible study as the best of all studies to the formation of a devout and noble character. My own views on this matter have been repeatedly expressed, and are well known both to the public and the educational authorities. I am sure that the vast, the overwhelming majority of the people of the Province were profoundly grateful for the unmistakeable testimony at that time given by this great association, that the heart of the Teachers' Association of Ontario beats sound upon this great question, and that you thoroughly endorsed the dictum then laid down, I think by your president, that a man who could not or would not teach the Bible was not fit to teach children at all.

It may be better for me, instead of speaking further upon a subject upon which most happily no division of opinion in this body exists, to offer a few remarks in reference to the volume of Biblical selections lately issued by the Minister of Education. Apart from the great advance made by the recognition of the Holy Scriptures as an integral and necessary part of our educational system, much of the educational value of the book appears to me to lie in its character as a volume of Biblical selections. We are thus forced to recognize the composite character of that Library of Revelation, including a literature extending over thousands of years, and the historical character of which it seems to me so important to teach. By means of this selection our scholars can hardly fail to recognize the gradual development of the Kingdom of God from the call of Abraham, as it came successively in contact with the varied civilizations of Egypt, of Phœnicia, of Assyria, of Babylon, and of Persia; how by the continuous demonstration of the inability of the chosen people to realize their destiny by themselves, the way was being gradually prepared for the coming of the Christ, whilst the hopes and fears and the devotional aspiration of each successive crisis are enshrined in the literature of the period, of which the most striking passages have been selected. Thus the student is led up to behold the Person and to study the teaching of our Lord in all their magic sublimity and tenderness, yet so accurately fulfilling the hopes of the generations of the past, and regenerating the future by the foundation of the Christian Church rising majestically under the work and teaching of apostolic builders. It certainly seems to me that as our youth has thus unfolded before it in each generation the grand central panorama of all history, it will be best qualified to profit by its searching analysis of human character, so pure and honest, yet withal permeated with the quickening breath of a higher and nobler life, or to receive its more distinctly dogmatic and spiritual teachings. Such teachings must, undoubtedly, in the present circumstances of the country, be left to the authorized spiritual guides of the various religious bodies, provision for which is so carefully made in the new regulations. One suggestion I would venture to make: it would be a great convenience to clergy who have several schools in their parishes if provision were made by authority that the same readings should be used at the same time in all the schools.

I see nothing whatever in the way of the use of a small handbook to the Selections, to be used either by the teacher alone or to be placed in the hands of the children, giving supplementary information with regard to the several selections as may be necessary for the complete understanding of their meaning and setting from an historical point of view. Nor do I believe that if such a book were edited in the same spirit as the volumes of the Cambridge Bible for Schools series, that any difficulty would be raised to its adoption. Of one thing I feel certain, that it only needs the subject to be thoroughly understood and placed fairly before them, and that then the Christian people of this Province will not long brook any obstacle which really stands in the way of the imparting throughout our educational system of a wise and liberal but at the same time Christian education; and that they are thoroughly in earnest in demanding that the education given to their children shall not merely fit them for the duties of this life, but shall also, as far as education can do so, mould their characters for God, for righteousness, and for truth.

C. W. E. Body.

ELEMENTARY EXPERIMENTAL CHEMISTRY.—II.

In the last Number we showed how the principal characteristics of chemical affinity may be deduced experimentally. In the present Number we shall investigate some of the fundamental propositions of chemical science.

Indestructibility of Matter.

Exp. 2. Take a piece of phosphorus about as large as a small pea, put it into a little water in a test-tube, and gently heat till it melts. Place the point of a thin wire in it and let it cool. The phosphorus will then be supported on the end of the wire. Bend the lower end of the wire into a spiral so that it will stand upright. Select a thin, light beaker, and a large, thin, and light flask of about 1500 cubic centimetres (about 2½ pints capacity.) Put about 400 cubic centimetres (¾ of a pint) of water, colored blue with litmus, into the beaker, place the wire in it, and invert the flask over the phosphorus with its mouth reaching almost to the bottom of the colored water. In this condition place the whole apparatus on a pair of scales and exactly balance it by weights in the other pan. In about forty-eight hours we shall find that the water has risen into the flask as if part of the air had been annihilated, and its color has changed from blue to red. The phosphorus has evidently wasted away as if part of its substance also had been destroyed. Nevertheless the apparatus weighs exactly as much as at first, showing that no loss can be detected. And yet, if the substance which has disappeared had been destroyed, the apparatus would weigh at least .43 of a gram less, which a good common balance would easily detect. What has taken place is this: the phosphorus has combined with the oxygen, which is one of the constituents of the air in the flask. The compound formed has been absorbed by the water, and remains unseen, but indicates its presence by changing the color of the water. This new substance contains all the oxygen and all the phosphorus which seemed to have been lost.

Hence we infer that *No loss of matter occurs in Chemical Combination.*

Exp. 12. Put a 2.16 grams of mercuric oxide into a test-tube, not too thin, which is provided with a bent tube, reaching just through the cork of a flask of about 200 cubic centimetres capacity, Let the flask be joined to another of equal size, by means of a bent tube which reaches almost to its bottom, but only just through the cork of the other. The first flask is to be nearly or quite full of water, and must be quite air-tight at the cork, whilst the second is empty and loosely corked. Place the whole apparatus, which must

be perfectly dry outside, upon the scales and accurately balance it by weights. Then heat the test-tube and decompose the mercuric oxide. The red powder will gradually waste away, globules of mercury collect on the side of the tube above the heat, while the oxygen passes into the first flask and drives the water over into the second. Leave the apparatus at rest for a short time till the tube becomes cold, and it will be found that the balance is undisturbed. The whole weight is just the same as the first.

Hence we infer that *No loss of matter takes place in Chemical Decomposition.*

First Great Principle in Modern Science. Many accurate experiments similar to the preceding have been made by chemists, and have proved beyond doubt that matter is never destroyed. Substances may disappear and seem to be lost, but the loss of matter is only apparent. During all the chemical changes through which substances may go, the balance shows that the weight remains the same; and when weight remains the same we are only following to its legitimate consequences the great principle established by Newton: *When weight remains we are persuaded that the material remains.* The *indestructibility of matter* is the first great principle of modern science, and to Lavoisier belongs the glory of having first distinctly asserted it.

The second great principle of modern science is that energy, which has been defined to be "The capacity, or power, of any body, or system of bodies, when in a given condition to do a measurable quantity of work," is also indestructible; but the consideration of this belongs to Physics rather than to Chemistry.

Constant Composition. The first great law concerning chemical combination discovered by the use of the balance is that of the invariable proportions of the constituents in any chemical compound. In whatever way any given chemical compound may be prepared, or in whatever manner its composition may be accurately ascertained, it is found always to contain a fixed and definite quantity of each of its constituent elements, *and this is a distinguishing characteristic of a chemical compound, as opposed to a mere mechanical mixture, the constituents of which may be present in any varying proportions.* Thus in the last experiment the 2.16 grams of mercuric oxide will yield two grams of mercury and .16 of a gram or 112 cubic centimetres of oxygen, and although the oxide can be prepared in several ways, the weight of mercury and volume of oxygen obtained are always found to be the same from the same weight of the oxide.

A great many experiments have been made in the same direction, and it has been found that every chemical compound which possesses a group of characters serving to define it, and so distinguish it from all other forms of matter, exhibits the remarkable constancy of composition exhibited by mercuric oxide. The inference clearly to be drawn from this is that *Chemical compounds are constant in composition.*

Law of Definite Proportions.—The admission of the constancy of composition of chemical compounds leads us to suspect that chemical combination takes place in *definite proportions.* Were it otherwise it would be impossible to give any adequate explanation of the fact that the constituents of mercuric oxide are always found in that body in fixed proportions. This may be put to the test by the following experiment:—

Exp. 13.—Into a small beaker pour about fifty cubic centimetres of hydrochloric acid, and drop into, it little by little, powdered sodium carbonate. Effervescence takes place, showing that gas is escaping, and that chemical action is going on. Continue until the last small quantity of the sodium carbonate produces no effervescence. The acid is then all neutralized. Then carefully stir in drops of the acid until with the last drop the last of the small quantity of solid carbonate disappears. The slightest quantity of either, beyond a certain *definite proportion*, remains unchanged. Hence we are led to the following law;—

First Law of Chemical Combination.—*The proportions in which bodies unite together chemically are definite and constant.*

Chemical Compounds and Mechanical Mixtures.—We find a variety of compound bodies in many cases closely resembling chemical compounds. To these various names are applied according to the nature of the substance, such for instance as *mechanical mixture*, solution, alloy, etc. But there is always a marked difference between them and true chemical compounds. The following experiment will illustrate this:—

Exp. 14.—Make a mixture of iron filings and sulphur in the proportion of thirty-six parts by weight of sulphur. A greenish gray powder results, but (1) distinct particles of both iron and sulphur can easily be recognized by a good magnifying glass. (2) Gently stir a portion of the powder into a tumbler of water. The heavy particles of iron fall quickly to the bottom of the tumbler, while the lighter sulphur more slowly subsides and collects as a distinct layer. (3) Stir the mixture with a small magnet, and the particles of the iron will firmly adhere to the magnet, while the sulphur can easily be blown away.

Hence we see that, *The constituents of the mixture can easily be separated by mechanical means, and that it partakes of the properties of both iron and sulphur.*

Exp. 15.—Heat a small portion of the mixture of iron and sulphur in a test-tube. The mixture becomes pasty and then glows for a short time, showing that chemical action is taking place. Break the test-tube and grind up its contents in a mortar. (1) When examined with a magnifying glass no particle of iron or sulphur can be detected. (2) It is no longer attracted by the magnet, or at least very little, and therefore contains little or no free iron. (3) *The iron and sulphur are no longer separable by mechanical means.* (4) If a small quantity be put into a test-tube and dilute sulphuric acid be added, a gas possessing a very offensive odor is evolved. Neither iron nor sulphur possess the property alone, of evolving this gas. The iron and sulphur have chemically combined forming iron sulphide, which possesses a definite group of characters which not only serve to distinguish it from the free elements iron and sulphur, or a mixture of them, but from all other bodies.

Hence we can distinguish a *chemical compound* from a mechanical mixture by the following characteristics:—

(1) The properties of a *chemical compound* differ entirely from those of its constituents.

(2) No purely mechanical means will suffice to separate the constituents of a *chemical compound* from each other.

The constituents of a *mechanical mixture* can always be separated by mechanical means.

(3) A *chemical compound* always contains a fixed and definite quantity of each of its constituents.

The constituents of a *mechanical mixture* may be present in any varying proportions.

The last characteristic is the one which, above all others, enables us to assert positively that a given body is or is not a chemical compound.

Exp. 16.—Take two copper wires, each about twenty centimetres in length, flatten an end of each, and to the flattened ends solder a strip of platinum, about two centimetres long by five millimetres broad. When these wires are connected with the wires from the battery they are usually spoken of as the *poles* of the battery. Dip the wires in melted paraffine, and wrap round each of them a thread of lamp-wick, previously soaked in paraffine. This will protect the copper from the action of the acid. Take a tumbler three-fourths full of water and add to it a teaspoonful of sulphuric acid for the purpose of increasing the conducting power of the water. Bend the copper wires over the sides of the tumbler so that the tops of the platinum strips may be about two centimetres below the surface of the water. Fill two test-tubes with water, acidulated with sulphuric acid, and place them over the platinum strips, keeping the tubes as near together as possible. Connect the wires with the galvanic battery and minute bubbles of gas will immediately be given off. It will soon be seen that twice as much gas is given off from the pole connected with the zinc end of the battery as from the pole connected with the platinum end; when the former is full the latter is only half full. As soon as the tube connected with the zinc end of the battery is full, close its mouth with the thumb, raise it out of the water, and examine its contents.

(1). Observe that the gas is colorless.

(2). Invert the tube and apply a match to its mouth; the gas takes fire and burns with a pale blue flame.

(3. Refill the tube. Turn its mouth upward and smell it. No odor is perceived. Hold the tube in this position for a few seconds, and then apply a lighted match to its mouth, no combustible gas is found in it. The gas has escaped, and is, therefore, lighter than air.

The gas possessing the above properties is called **Hydrogen.** It is considered to be an elementary body. It will be fully treated of *in a future number.*

If the gas in the other test-tube be examined in the same way, it will be found that it will not take fire. Immerse in a glowing

splint of wood. The wood will instantly take fire and burn with great brilliancy. Hence the gas has the same characteristic as that obtained by heating mercuric oxide and is therefore *Oxygen*.

The above process is called *electrolysis* and is frequently employed in decomposing chemical compounds.

When the above experiment is carefully made, it is found that the only substance that undergoes permanent change is the water. The weight of the water is diminished in exact proportion to the amount of gas evolved. Besides, if the operation is continued the water will be *completely* resolved into the two gases.

Exp. 17.—Take a strong glass tube, about thirty centimetres long and one centimetre in diametre. Choose a good, sound cork, pass two short copper wires through it, connecting their extremities within the tube with fine platinum wire. Insert the cork tightly in the tube and cover it with sealing wax. Such a tube is called a *Eudiometer*, of which there are many forms. Now, fill the tube with acidified water, and place it over the platinum strips, taking care that they do not touch each other. When the tube is about two-thirds full of water, press it firmly against an india rubber or paper pad on the bottom of the tumbler, wrapping a towel loosely round the tube, and connect wires in the cork with the battery. The fine platinum wire will soon become red-hot and explode the gases. On raising the tube from the pad, the water will rush up and fill the tube, showing that the two gases have united to form water which appears as vapor on the tube before it is raised from the pad.

Water is, therefore, composed of two gases, Oxygen and Hydrogen, in the proportion of one volume of the former to two volumes of the latter.

Combination by Volume.—In the preceding experiment if the union of the oxygen and hydrogen be effected in an apparatus so arranged that the gases before explosion are heated beyond the temperature of boiling water and kept at the same temperature after explosion, it is found that the two volumes of hydrogen and one volume of oxygen which were mixed together have become chemically united into *two volumes* of steam. It is found in other cases also that **Whatever the number of volumes which enter into combination, the resulting compound is two volumes.**

Exp. 18.—Take two glass tubes, about one metre in length and five millimetres in diameter. Close one end of each and bend so that the short limb may be about twenty centimetres long. Fill one of them with acidulated water, colored with litmus or cochineal, and place it over the pole from which the hydrogen is escaping, until enough is collected to half fill the short limb of the tube. Turn the short limb uppermost and the gas will pass into it. Half fill the short limb of the other tube with oxygen in the same manner.

(1). Observe that when both limbs are full of water the gases are equally compressed.

(2). By means of a pipette, to which a piece of rubber tubing or a piece of fine glass tubing is attached, adjust the water in each tube so that it may stand at various heights, but always at the same height in each tube. Observe that the gases expand equally as the water is removed.

(3). If you have mercury pour an equal quantity into each tube, and observe that the gases contract to the same extent.

(4). Plunge the tubes into boiling water. Observe that the gases expand equally.

(5). Plunge the tubes into ice-cold water or a freezing mixture, and the gases contract to the same extent.

Hence we infer that *Oxygen and Hydrogen gases when compared under the same conditions are affected in the same way and to the same extent by equal alterations of pressure and temperature.*

When the same mode of investigation is applied to other gases, whether elementary or compound, the following important characteristics are observed :

(1). All true gases obey the same law of compressibility.

(2.) Equal volumes of all true gases expand equally on the same increase of temperature.

The conlusion that must necessarily be drawn from the preceding facts is, that all gases, however different chemically, must be physically constituted alike. Upon these facts an Italian chemist, Avogadro, based a most important hypothesis. He assumed that all substances, solid, liquid, and gaseous, are made up of an innumerable number of little particles which he called *molecules*, and was thence led to the enunciation of the following law

AVOGADRO'S LAW. **When in the condition of a perfect gas, all substances under like conditions of temperature and pressure contain in equal volumes the same number of molecules.**

Relative Weight of Molecules. The above law, enunciated by Avogadro, in 1811, is considered one of the most important in the whole range of chemical science. It is to the chemist what the law of gravitation is to the astronomer. We have indicated only one of the evidences in its favor. It is in reality a generalization from a large mass of facts, and the best proof of its validity is to be found in the circumstance that it not only explains the known facts of chemistry, but also, that it is constantly leading to new discoveries. It gives at once the means of determining directly the relative weight of the molecules of all substances that can exist in the state of gas. For it is obvious that **The ratio of the weight of volumes of gases, compared at the same pressure and temperature, must represent the relative weight of the molecules of these gases.** Now it is found by experiment that given volume of oxygen is sixteen times heavier than an equal volume of hydrogen, under the same conditions ; therefore, *the molecule of oxygen is sixteen times heavier than the molecule of hydrogen.*

Atomic Weight of Elementary Gases.—It has been shown that two volumes of hydrogen unite with one volume of oxygen to form two volumes of steam ; and by Avogadro's Law we know that the two volumes of steam contain the same number of molecules as the two volumes of hydrogen, hence we have—

2 vols. hydrogen + 1 vol. oxygen=2 vols. steam,
or 2 mols. " +1 mol. " =2 mols. "

Now, in the two molecules of steam there is but one molecule of oxygen ; therefore in one molecule of steam there can only be half a molecule of oxygen, and the weight of the oxygen corresponding to the semi-molecule is the smallest quanity of that gas that can take part in any chemical change, and as it cannot be further divided by any chemical means it is called an *atom*. We shall find that the molecule of hydrogen can also be divided into two parts, and that one of these parts is the least quantity of hydrogen known to take part in any chemical action, and is, therefore, called an *atom* of hydrogen. It has been found convenient to take 1 as the *atomic weight*, or weight of a semi-molecule of hydrogen. The weight of the molecule of hydrogen is, therefore, 2 ; and since oxygen is sixteen times heavier than hydrogen, the molecule of oxygen is 32, and consequently its atomic weight is 16.

Hence, **To find the atomic weight of an elementary gas, it is only necessary to find its weight compared with hydrogen as the unit.**

Specific Gravity of a Compound Gas.—Suppose that in a given volume of steam there is a certain number of molecules, then by Avogadro's Law the same volume of hydrogen will contain the same number of molecules. Therefore, the weight of a given volume of steam has the same ratio to the weight of an equal volume of hydrogen that a molecule of steam has to a molecule of hydrogen. But the molecule of steam is made up of two atoms of hydrogen and one atom of oxygen ; its *molecule weight* is therefore, 18, and the molecule weight of hydrogen is 2, or the ratio is 9 to 1. Therefore, the specific gravity of steam compared with hydrogen as the unit is 9.

Hence, **The specific gravity of a compound gas compared with hydrogen as the unit is found by taking half its molecular weight.**

Conversely, **To find the molecular weight of a gas it is only necessary to find its specific gravity referred to hydrogen as unity, and then multiply it by 2.**

Definitions.—From the preceding paragraphs we have the following definitions :—

Molecule.—*A molecule is the smallest partide of a compound or element that can exist in a free state.*

Atom.—*An atom is the smallest portion of a chemical element that is known to take part in a chemical change, and is almost invariably the semi-molecule.*

Atomic Weight.—*The atomic weight of an element is the smallest proportion, by weight, in which it enters into or is expelled from a chemical compound, the weight of hydrogen being taken as unity.*

Molecular Weight.—*The molecular weight of an element or compound is the sum of the atomic weights of the element or elements comprising its molecule.*

Chemical Notation.—Instead of writing the names of the elements in full, chemists have agreed to use a set of symbols to represent them. These symbols, however, not only represent the particular element but also *a certain definite quantity of it;* thus, the letter **H** always stands for 1 atom, or 1 part by weight of hydrogen; the letter **O** stands for 1 atom, or 16 parts by weight of oxygen. Compounds are in like manner represented by writing the symbols of their constituent elements side by side, and if more than 1 atom of each element is present, the number is indicated by a numeral placed on the right of the symbol of the element below the line. Thus water is represented by the symbol H_2O, that is, a compound of 2 atoms of hydrogen with 1 atom of oxygen, or 2 parts by weight of hydrogen with 16 parts by weight of oxygen. Again, sulphuric acid is represented by the formula H_2SO_4, which is a statement that it consists of two atoms of hydrogen, one atom of sulphur, and four atoms of oxygen, and consequently a certain relative weight of these elements. A figure placed to the right of a symbol only affects the symbol to which it is attached, but when placed to the left all the symbols are affected by it; thus $2H_2O$ means two molecules of water.

The great value and comprehensiveness of the symbols in chemistry may be illustrated by the amount of information condensed into the concise expression H_2O. We learn from it:—

(1.) The *number* and *names* of the elements entering into the composition of water.

(2.) The *ratio* in which the elements are united in this compound by *weight.*

(3.) The ratio in which the elements are united therein by *volume.*

(4.) The *ratio* in which the volume of the compound *when formed* stands to the volume of the constituents *before combination.*

(5.) The relative *volume-weight* or specific gravity in the state of gas (water-gas), hydrogen being taken as unity.

Chemical Equations. Chemical symbols give at once a simple means of representing all chemical changes. As these changes almost invariably result from the reaction of one substance on another, they are called Chemical Reactions. When the symbols of the elements are written with a figure to the right, this indicates a molecule of the element, the symbol alone representing an atom. Since, in all cases of chemical change, the change is necessarily between molecules, such symbols should, when possible, be employed. Thus, the formation of steam (water-gas) from hydrogen and oxygen is correctly represented by the equation:—

$$2H_2+O_2=2H_2O;$$

that is to say:

(1.) Two molecules of hydrogen and one molecule of oxygen give two molecules of steam.

(2.) That a certain definite weight, say four grams of hydrogen, and thirty-two grams of oxygen, furnish thirty-six grams of steam or water-gas.

(3.) Four volumes of hydrogen and two volumes of oxygen furnish four volumes of steam or water gas. A simple equation like the above, therefore, when properly interpreted affords a large amount of information, whilst the equation—

$$H_2+O=H_2O,$$

merely represents the relative weights of the elements which enter into the mixture, and is not a complete expression of what is supposed to take place.

In every chemical reaction the substances which are involved in the change are called the *factors,* and the substances produced the *products* of the reaction. As matter is indestructible it follows that *the sum of the weights of the products of any reaction must always be equal to the sum of the factors,* and further, that *the number of atoms of each element in the products must be the same as the number of atoms of the same kind in the factors.*

☞ It is necessary to bear carefully in mind that a chemical equation differs essentially from an algebraic equation. Any inference that may be legitimately drawn from an algebraic equation must, in some sense, be true. It is not so, however, with chemical equations. These are simply expressions of observed facts, and, although important inferences may sometimes be drawn from the mere form of the expression, yet they are of no value whatever unless confirmed by experiment. Moreover, it is important to discriminate with the greatest care between the facts directly stated or expressed by the equations, and the inferences drawn from them.

Practical Department.

DRAWING.

BY WILLIAM BURNS, DRAWING MASTER, HIGH SCHOOL, BRAMPTON.

The aim of this series of papers will be to set before such of our public-school teachers as may not previously have taught the subject of Drawing, an outline of a course sufficiently extensive to enable a class commencing this branch to qualify, at least, at the December entrance to High Schools. It will obviously be impossible to enter into minute details in the space and time available, but should difficulties arise the author of these lessons will be glad to reply to any queries through the columns of the JOURNAL, as it not unfrequently happens that a doubt or question which suggests itself to one mind has already been present in many others, and therefore becomes of more than individual interest in the answering.

Let me remark at the outset that teachers should take courage in undertaking this comparatively new branch of common school education. How often during the past few months has the exclamation been heard from good and even experienced teachers—"I can never teach Drawing; I can never be an artist." The latter may be quite true, perhaps, but it should be remembered that a good artist is not necessarily a good teacher of Drawing. What the Department has in view in this branch is obviously the training of the children to observe what they see; and any one can direct their attention to numerous facts of which they were quite aware before and which they had seen many times and yet had never properly observed. To this consideration I would more especially urge our teachers to pay great attention. From experience I can assure them that all such time is well spent. Again, how much more interesting is a Reading lesson if the teacher can explain pictorially as well as verbally. Of this fact the numerous engravings in our new Readers are a sufficient recognition, and still more interesting and instructive to children are even rough sketches on the board of the objects mentioned to them. This fact alone makes Drawing deserve the fullest attention of the teacher.

It is usual in commencing to give a series of elaborate "cautions" to the pupil, but here it will be sufficient briefly to mention the points to which attention should be specially directed at first by the teacher. Perhaps others may be mentioned in the course of these papers.

1. Let the pupils be provided with pencils, properly sharpened. Be very careful not to allow use of small fragments of pencil. It is a bad habit and tends to encourage carelessness. The paper should be of fair quality and not highly glazed. The use of eraser should be discouraged, it is apt to induce carelessness in work. Occasionally let the work be given in with all the lines of construction or errors remaining intact.

2. Do not be too exacting from your pupils. In nothing so much as in Drawing will you find differences even in a class of equal average ability. So long as progress in idea, neatness, correctness and knowledge is made, be sure that no part of your time has been wasted. If a drawing is badly executed, and the pupil can show you the fault himself, you have gained one very great point, viz.: you have taught him to judge of correctness by eye alone; and this in itself is the first great step towards improvement in the next copy. Gradual progress will be more marked in this than in any other subject.

3. Let the drawing lesson be connected with some other branch of school-work and accessory to it. Every one can see how fractions can be shown pictorially by a divided line, and so it is with

other arithmetical ideas. All the definitions of geometrical figures can be learned by the pupils before they begin Euclid. Above all I would recommend the use and explanation of scales in the work. This will very materially lighten the teacher's labor, as it will enable him to use the diagrams published in so many works on Drawing. I am only speaking from experience when I say that many of our pupils already know, practically, the use of tracing-paper; and it will require all the care of the teacher to counteract this practice. The best plan is openly to explain it,—then set the exercise on another scale, say twice, thrice, one-half, &c., the scale of copy. This knowledge becomes of great practical use in geographical explanations of distance.

Try to prevent slavish copying even of your own Blackboard exercise. A little praise betowed on originality of work, on a reversed copy, or on some additional ornament, &c., will soon cause your pupils to try and gain this approval, and they will find far more pleasure in pursuing their own fancy than in merely copying yours.

In conclusion, let me remind younger teachers, that repetition is the essence of true instruction. By this I do not mean the use of the same exercise over and over again without change or variety, but that the subject in hand must be repeated constantly till it is part of the pupils mind, without thought. By short lessons, and long time for practise; by continually going over the old ground; by making slow advance on the new,—this repetition can be easily obtained. It is not an inadvisable plan to have a few patterns on some unused portion of the board which can be drawn in their books by pupils, at those leisure moments that occur in most schools, and which are too often a great source of anxiety to the teacher; and thus may be gained the two ends of quiet work and progress in study together with the necessary time to devote to another class or portion of class according to the exigencies of the case.

In the next paper will be commenced a practical course on "straight-line" drawing, and figures which may be drawn by means of straight lines only.

SCHOOL GOVERNMENT.

The following principles are adapted from Bentham, who, first among English lawyers, enunciated the basis on which all governments should be administered:

LIMITS OF CONTROL.

1. Authority exists for the benefit of the pupils.
2. Restraints should be as few as possible.
3. Duties and offences should be clearly expressed.
4. Offences should be graduated according to degree.
5. The teacher should observe due formality in exercising authority.
6. The teacher should avoid occasions of disorder by organization.
7. Those in authority should cultivate a benign character.
8. Reasons for discipline should be made intelligible.
9. Punishments should be regulated according to certain principles, as,—
   - *a.* The punishment should be such as is best adapted to the offence.
   - *b.* Never punish in anger.
   - *c.* Except in extreme cases, never administer corporal punishment without the consent of parents, etc.

MEASURE OF PUNISHMENT.

1. It should not outweigh the profit of the offence.
2. The sensibility of the offender should be considered.
3. In case of two offences, the punishment should be such as to make the less preferred.
4. The punishment should not be greater than is needed.
5. The greater the offence, the greater the expense it is worth while to be at in the way of correction.
6. The punishment must be increased as it falls short of certainty.
7. When the offence indicates a habit, the punishment should be adjusted to counteract that habit.
8. In adjusting the measure, account *should be taken of the* circumstances that render all punishment unprofitable.
9. In administering punishment, omit all those things that do *more harm than good.*

All the motives that result in a given offence may not be observed at a glance and readily referred to a classified list, and the means and measure of correction are not always obvious.—*Our Country and Village Schools.*

WRITTEN SPELLING AND LANGUAGE WORK.

BY HATTIE R. FOULKE, *MUSCATINE, IA.*

The subject of spelling, like nearly every other matter pertaining to the public schools, has been worn threadbare; and as I can not add anything to make what has been said stronger I will simply give the plan that I have been using. It might be called the sentence method. Most of us agree that written spelling in whatever form used gains the practical results. We all know it to be a fact that children can spell whole columns of words, many of them catch words, and yet cannot without practice write half a dozen sentences from dictation without misspelling a dozen words. It has been my custom in using the written spelling to let the pupils choose the words for the lesson. At first using three, now five words a day. For instance, five scholars, selected at random give each one a word, which if correctly spelled I place on the blackboard. No word is put down unless correctly spelled by the one giving it, and as they are all anxious that their words should be used they usually give them correctly. Thus one word a day is learned in such a way that it will not soon be forgotten. The five words on the board are then given to the class to be placed in sentences, either a sentence for every word or as many words as possible in one sentence. They are also required to spell as many of the other words of the sentence correctly as possible.

They enjoy making these sentences and try to get one that they think no one else will have. This calls for originality. Give a child any thing he likes to do and he will invariably do it well. One would be astonished to note the improvement in composition in the course of a few weeks, and the success of the plan depends very much on the composition. For instance, when we first began the sentences were nearly all like these: "I see a chair," "I see a desk," giving no variety of words to be spelled. Near the beginning of our sentence spelling the word "mittens" was given. Nearly all had the sentence "I have a pair of mittens," pair being spelled without exception pare or pear. After some weeks the word rubbers was given and again all used the word pair, and with the exception of three in a class of eighteen or twenty all spelled it correctly and naturally.

I have the spelling exercises the last thing in the forenoon, and on going home the slates are left on the desk for correction. When I find a word misspelled I mark it and place the correct word below so that when the pupils return in the afternoon they can change the word for themselves. After correction, the sentences are read before the school. Sometimes they are allowed to tell which they think best, and if the sentences are ungrammatical some one in the class makes the correction.

This sentence writing has another advantage, that of teaching the correct use of language. In the usual routine of daily work a child has little chance for expressing himself so that his language may be corrected. The stereotyped phrases, "I ain't got no pencil" and "3 and 2 is five" is about the only chance the poor child has in the school room for using his own language even to abuse it. In this written work they have all variety of words, consequently all kinds of subjects upon which to express themselves. One day the word pony was used in the lesson, and one little fellow had the sentence "My! but I wish I had a pony." For an illustration of our work I will take one of our lessons for last week. The words given were "lamp," "times," "hundred," "Cleveland." When the lesson was done one sentence read, "Cleveland had a lamp lit when he was elected, and a fire in his stove and he had put wood in three times; and there were a hundred men in the office." Another had, "Write Cleveland, lamp and stove a hundred times." And another "I think a hundred years ago little children were burned many times by a lamp and with a stove too; I think Cleveland was burned." Others had three or four sentences for the different words. One had "I can not write sentences with times." There is a great variety of sentences and the reading of them is quite an interesting exercise which all enjoy. I have also once a day written spelling from dictation, keeping a list of words used and writing them as a review. Also a drill once a week on words of different meaning and spelling and similar sound, as write, heir, there, pair, etc.

Our aim in all school work should be, not to teach pupils to spell a certain list of words, work a certain set of examples, or to read to the end of a certain series of readers. But we should aim to make children intelligent. Upon this one point depends our only hope of practical success.—*Iowa Teacher.*

Educational Notes and News.

Mr. Edmund B. Harrison has resigned the position of Inspector of Public Schools for East Kent.

Four pupils of the St. George P. S. passed very successfully the recent Entrance Examination, and two former pupils of the school took Third Class certificates. Mr. J. C. Elliot is Head Master.

The attendance at the Ontario Business College, Belleville, within a short period has embraced students from fifteen different provinces and states. This shows how widespread the reputation of the school has become.

Miss F. Gillespie, of Prince Edwards, Mr. J. B. Davidson, of Perth, and Mr. F. S. Falconer, Middlesex, pupils of the Ingersoll High School, were successful at the recent First Class Teachers' Examination. Miss Gillespie has obtained a situation as assistant in the Picton High School, Mr. Davidson has been appointed assistant is the Woodstock Model School, and Mr. Falconer takes a school in the county of Perth.

Encouraged by the growing demand for more extended training in Expression, The National School of Elocution and Oratory of Philadelphia, last year, enlarged this Graduating Course of Instruction from eighteen weeks to one year. The experiment has been very successful. They have also increased their staff of Instructors and the number of hours of instruction per day, without adding to the cost of tuition; in fact, the rates for instruction are materially less than heretofore. The fall term begins on Monday, Sept. 28th.

Mr. J. S. Deacon, late head master of the Woodstock Model School, has been appointed to the inspectorship of Public Schools in the County of Halton, made vacant by the death of the late Inspector Little.

The teaching staff of the Chatham High School has been augmented by the following teachers. Mr Twohey, M A, gold medallist, Toronto University, salary $800, classical master. Mr. W. J. Chisholm, B. A., honor graduate and medallist, of Victoria University, salary $700, English and modern languages. Mr Short, graduate of Toronto University, junior assistant, salary $500.

Miss Airth, a young lady whose house is at Shelburne, Ont., but who is at present visiting relatives in Florida, has recently received from the management of the World's Exposition in New Orleans a diploma and award of merit for a beautifully etched table which she had on exhibition there. Considering the magnitude of the Exposition, in which works of art were ranged in competition from all parts of the world, Miss Airth's success is highly creditable, not alone to herself, but to Canadian art as well.—*Globe.*

Some clerical errors occurred in the list of Woodstock High School pupils, who passed the Teacher's Non-Professional Examination, as published last week. We give the corrected list:—

SECOND CLASS—GRADE A.

E. Ella Campbell, Helen Douglas, M. McPherson, M. Markle, Alice Stuart, Alice White, Thos. Heeney, J A McDonald, E P. Whyte.

GRADE B.

Joan Sherran, Sarah Stephenson, D. G. Revell, Alb. E. Scott, J. G. Robson, E. Lang.

THIRD CLASS.

Anne Bayne, Lizzie Douglas, A. Geddes, M. Moncur, L. Overholt, May Rose, M. B Topping, M. S. Webster, D. S. Matheson, R. H. Weaver, E. G. Bardwell, A. G. Palmer, C. O. Bertrand, N. Milmine, W. P. Robinson, C. E. Hendershott, Jno. O. Lewis, E. L. Danbrook, Chas. F. Lyster, Jno. Miller, C. Horseman.

REGULATIONS RESPECTING TEACHERS' CERTIFICATES AND THE COURSE OF STUDY IN HIGH SCHOOLS AND COLLEGIATE INSTITUTES.

(*From the new Regulations.*)

93. Pupils, on entering the High School, shall pursue one or other of the following Courses.—(*a*) That prescribed for a High School Commercial Course. (*b*) That prescribed for Matriculation into any of the Universities of Ontario, or for the Preliminary Examination of any of the learned professions. (*c*) That prescribed for a Teacher's Non-professional Certificate. Special Classes for the study of Agricultural Chemistry may be established by the Trustees, with the concurrance of the Head Master.

94. Any High School pupil may take, in addition to the subjects in the course selected, such subjects in any of the other courses as may be agreed upon by his parent or guardian and the Head Master of the High School; but no subject not mentioned in the High School Course of Study shall be taken up by any pupil without the consent of the Education Department.

95. In classifying his pupils, the Head Master shall be guided by the capabilities of his pupils and the circumstances of the school. The Head Master is not restricted in the sub-division of Forms, but he shall make at least two sub-divisions in Form 2.

96. It shall be the duty of the Head Master to prescribe the number of pupils in each Form, the division of subjects among his assistants, and the order in which each subject shall be taken up by the pupils—whether or not all the subjects in the Course of Study shall be taught concurrently; also, to make such promotions from one Form to another as he may deem expedient; and generally so to limit the sub-divisions of each Form as will best promote the interests of his pupils.

97. In every High School and Collegiate Institute, Vocal Music should be taught, as well as the theory thereof; Chemistry and Physics should be taught experimentally, and Botany practically; and it shall be the duty of the High School Inspectors to report specially those schools in which this recommendation is not observed. Drill and Calesthenics shall also form part of the obligatory course.

98. The following subjects as herein limited, shall constitute the Course of Study in the different Forms:—

Form I.

1. *Reading (oral) and Principles of.*—A general knowledge of the principles of elocution ; reading with proper expression, emphasis, inflection, and force.

2. *Orthography and Orthoepy.*—The pronunciation and syllabication, and the spelling from dictation, of passages from any English author, and the spelling of all non-technical English words.

3. *English Grammar.*—Etymology and Syntax ; exercises.

4. *Composition.*—The framing of sentences and paragraphs ; familiar and business letters ; paraphrasing , synonyms ; correction of errors ; themes based on the prose literature prescribed for this Form.

5. *Literature.*—The critical reading of such works as may be prescribed by the Education Department from time to time.

6. *History.*—The leading events of Canadian and English history

7. *Geography.*—Political, physical, and mathematical Geography. Map Geography generally , Canada and the British Empire more particularly.

8. *Arithmetic and Mensuration.*—Arithmetic in theory and practice ; areas of rectilinear figures, and volumes of right parallelopipeds and prisms ; the circle, sphere, cylinder, and cone ; Mental Arithmetic.

9. *Algebra.*—Elementary rules ; factoring : greatest common measure ; least common multiple ; fractions ; simple equations of one, two, and three unknown quantities ; simple problems.

10. *Euclid.*—Book I., with easy problems.

12. *Physics.*—The elements of Physics, as treated in Huxley's Introductory Science Primer and Balfour Stewart's Science Primer.

14. *Botany.*—The elements of structural Botany, including systematic examinations of common plants selected to show variety of structure in the different organs ; true nature of the parts of the flower ; various forms of roots, structure and uses, how distinguished from underground stems ; various forms of stems, bulbs and tubers, herbs, shrubs and trees ; nature and position of buds ; forms and disposition of foliage leaves ; kinds of inflorescence, special forms of flower-leaves, morphology of the calyx, corolla, stamens, and pistil ; modifications of the flower due to adhesion, cohesion and suppression of parts ; classification of fruits ; the seed and its parts; germination ; the vegetable cell ; protoplasm ; chlorophyll ; formation of new cells ; various kinds of tissues ; intercellular spaces ; structure of leaves ; exogenous and endogenous growth ; food of plants ; reproduction in flowering plants ; nature of the pollen-grain ; fertilization of the ovule ; reproduction in ferns , the spore. Outlines of classification ; examination and classification of common plants belonging to the following natural orders.—Ranunculaceæ, Cruciferæ, Malvaceæ, Leguminosæ, Rosaceæ, Sapindaceæ, Umbelliferæ, Compositæ, Labiatæ, Coniferæ, Araceæ Liliaceæ, Triliaceæ, Iridaceæ, Gramineæ ; the characters and general properties of these orders.

15. *Latin.*—The Elementary Latin Book, grammar, composition, and the texts prescribed from time to time by the Education Department.

16. *Greek.*—The Elementary Greek Book.

17. *French.*—The Elementary French Book, grammar, composition, and the texts prescribed from time to time by the Education Department.

18. *German.*—The Elementary German Book, grammar, composition, and the texts prescribed from time to time by the Education Department.

19. *Writing.*

20. *Bookkeeping.*- Single and double entry ; commercial forms ; general business transactions.

21. *Drawing.*—Freehand ; practical Geometry ; perspective ; industrial designs.

22. *Music.*—Vocal and Theoretical.

Form II.

1. *Reading.*—Course for Form I. continued.

2. *Orthography and Orthoëpy.*—Course for Form I. continued.

3. *English Grammar.*—Course for Form I. continued. (As prescribed for the Pass Matriculation Examination of the University of Toronto.)

4. *Composition.*—Course for Form I. continued.

5. *Literature.*—The critical study of the texts prescribed from time to time for the Pass Matriculation Examination of the University of Toronto.

6. *English History* (including Colonial History.)—From William III. to George III., inclusive. Roman history from the commencement of the second Punic War to the death of Augustus. Greek history from the Persian to the Peloponnesian Wars, both inclusive (University Pass.)

7. *Geography, Modern.*—North America and Europe. *Ancient.*—Greece, Italy, and Asia Minor.

8. *Arithmetic.*—Course for Form I. continued (University Pass).

9 *Algebra.*—To the end of Quadratics (University Pass).

10. *Geometry.*—Euclid books I., II., III. ; easy deductions (University Pass).

12. *Physics.*—Definitions of velocity, acceleration, mass, momentum, force, moment, couple, energy, work, centre of inertia, statement of Newton's Laws of Motion, composition and resolution of forces, condition for equilibrium of forces in one plane. Definition of a fluid, fluid pressure at a point, transmission of fluid pressure, resultant fluid pressure, specific gravity, Boyle's Law, the barometer, air pump, water-pump, siphon (University Matriculation Examination.)

13. *Chemistry.*—Reynold's Experimental Chemistry (chaps. I to XVI inclusive.)*

14. *Botany.*—Course in Form I. continued.

15. *Latin.*—Examination subjects as prescribed from time to time for Pass Matriculation into the University of Toronto.

16. *Greek* " " " " " "

17. *French* " " " " " "

18. *German* " " " " " "

19. *Writing.*—Course for Form I. continued.

20. *Book-keeping and Commercial Transactions.*—Course for Form I. continued.

21. *Drawing.*—Course for Form I. continued.

22. *Music.*— " " "

23. *Precis-writing and Indexing.*

23. *Phonography* (optional.)

Form III.

3. *English Grammar.*—Course in Form II. continued.

4. *Composition.* " " "

4. *Literature.*—The critical study of the texts prescribed from time to time for Honor Matriculation into the University, Toronto.

6. *History.*—English History under the Houses of Tudor and Stuart.

7. *Geography.*—The British Empire, including the colonies (Honor Matriculation University.)

9. *Algebra.*—To the end of Binomial Theorem (Honor Matriculation University).

10. *Geometry.*—Euclid Books I., to IV. inclusive, Book VI and definition of Book V. (Honor Matriculation University.)

11. *Trigonometry.*—(Honor Matriculation University) The solution of Triangles.

13. *Chemistry.*—Reynolds' Experimental Chemistry, chaps. I. to XXVI. inclusive. (The University Matriculation Examination.)

14. *Botany.*—The structure and classification of Canadian flowering plants. (The University Matriculation Examination.)

15. *Latin.*—The course as prescribed from time to time for Honor Matriculation and the University of Toronto.

16. *Greek* " " " " " " " " "

17. *French* " " " " " " " " "

18. *German* " " " " " " " " "

Form IV.

99. The subjects for study in Form IV. shall be those now prescribed by the University of Toronto for Senior Matriculation, Pass and Honors. As far as possible, the classes shall be the same as those in Forms II and III.

Commercial Course.

100. Candidates for a diploma in the Commercial Course will be examined at the same time and place, and on the same papers as candidates for second class non-professional certificates.

Graduation Diploma.

101. Any Pupil who passes the Departmental or the University examination in any of the courses herein prescribed for Forms II., III. or IV., in High Schools, shall be entitled to a Graduation Diploma signed by the Minister of Education and the Head Master of the High School at which such course was completed.

*Reynold's Chemistry is here referred to not as a text-book to be placed in the hands of High School pupils, but as a guide to the teachers, both in methods of illustration and in the limits of the course.

CERTIFICATES OF ATTENDANCE AND CHARACTER.

102. In addition to passing the prescribed examination, each candidate for a Graduation Diploma shall submit to the Education Department, through the Head Master, the following documents: (1) A certificate from the Head Master that the candidate is a High School pupil who has attended for at least one year. (2) A certificate of character signed by the Head Master.

PRESENTATION OF DIPLOMAS.

103. Commencement Exercises should be held in each High School or Collegiate Institute, at a suitable time during the Autumn term of each year, at which the Graduation Diplomas may be presented to the successful candidates.

DUTIES OF TEACHERS AND PUPILS.

104. The regulations respecting the duties of teachers and pupils in High Schools shall be the same as those affecting teachers and pupils in Public Schools, except as herein otherwise provided.

QUALIFICATIONS OF HEAD MASTERS AND ASSISTANTS.

105. The qualifications for the Headmastership of a High School or Collegiate Institute shall be (a) a degree in Arts obtained after a regular course of study from any chartered university in the British Dominions, and (b) one year's successful teaching either as assistant master in a High School or in a College or a Private School.

106. After the first day of July, 1885, no one shall be deemed qualified for the position of High School Assistant unless he hold a First Class Professional Public School Certificate; or unless he be a Graduate in Arts (as above), or an Undergraduate in Arts of at least two years' standing, who has obtained a professional certificate at a Training Institute.

107. Any teacher who is not qualified as above, but who, on the first day of July, 1885, is employed as an Assistant in a High School or Collegiate Institute, shall be deemed a legally qualified Assistant for such High School, but for no other.

Question Drawer.

The following lines from Goldsmith's Traveller were given for analysis at the Teacher's Examination in Algoma and Parry Sound:—

"Bat me not destined such delights to share,
My prime of life in wandering spent and care:
Impelled with steps unceasing to pursue
Some fleeting good, that mocks me with the view;
That, like the circle bounding earth and skies,
Allures from far, yet, as I follow, flies;
My fortune leads to traverse realms alone,
And find no spot of all the world my own."

A *complete analysis* of the forgoing will be gratefully received by an ALGOMA TEACHER.

Please let me know where I can get a book entitled "Living Thoughts of Great Thinkers," and oblige QUIS.

Will you please inform me through the JOURNAL the following: (1). Are Book-keeping and Botany required for 3rd class Teachers' Examinations. (2). To whom should I now send subscription to Superannuation Fund. (3). When will the prizes be distributed for the Arithmetic Competition? A. McG.

(1). In 1883, I obtained a Third-Class Non-professional Certificate. If I only try for my Professional *this Fall* at the Co. Model, will it still hold good for three years after. (2). To how much of the holiday pay is a teacher who teaches the first six months in the year entitled? K. G. B.

ANSWERS.

QUIS. We do not know a work by that title, "Living Thoughts of Leading thinkers," by S. P. Linn, is published by Henry J. Johnson, New York. Can be ordered through any bookseller. $2.00.

A. McG.—(1). Book-keeping is required. An option is allowed between Physics and Botany, (groups 12 and 14), and the subjects named in groups 15, 17 and 18, of the High School Course as published in this issue. Next week we will publish the requirements for Teachers' Certificates in full.

(2). To the Secretary of the Education Department.

(3). Cannot give definite answer this week. Hope to make announcement soon. Holidays have caused delay.

K. G. B.—(1). Yes. The Professional certificate holds good for three years from the time it is granted without regard to the date of the Non-professional.

(2). That depends upon the agreement. If the matter is not specified in the agreement the teacher is entitled to a sum which bears the same proportion to a full year's pay which the number of days he taught bears to the whole number of *teaching* days in a year.

The following Answers to Questions in No. 26, (July 2nd), have been crowded out of late numbers of the JOURNAL.

1. Field 40 rods long, containing 2 acres or 320 sqr. rods. 320 ÷ 40 = 8, rods, width of field. Hence 40+40+8+8=96 rods, or 1584 ft. the perimeter of field, 1585÷12=132. No. of trees.

2. Cubic inches of space occupied by balls, $.5236 \times 3^3 \times 64 = 904,7808$.

Cubic inches contained in box, $12^3 = 1728$.
$1728 - 904.7808 = 823.2192$. ANS.

3. $1387.18 \div 25.20 =$ No. of sovereigns.
$\$4\frac{1}{4} \times 1.07\frac{1}{2} = \$4.79\frac{1}{4}$, value of sovereign.
$\frac{1387.18}{25.20} \times 4.79\frac{1}{4} = \$263.92$. ANS.

6. 3 men and 2 boys do as much in 2 days as 5 boys in 6 days, and do 3 times as much in 6 days; do as much as 15 boys.

3 m. = 13 b. 1 boy does the work in 120 days, 1 man in $27\frac{9}{13}$ days.

7. Equalize the number of women in the two companies, and the conditions will stand thus:

6 wom., ...4 boys, ...$3\frac{1}{2}$ days.
6 " ....9 " ....$2\frac{2}{7}$ "

5 boys do in $2\frac{2}{7}$ days what 6 w. 4 b. do in $\frac{20}{21}$d.; do $\frac{1}{2}$ as much in same time.

∴ 12 b. = 6 w. 4 b. and 8 boys = 6 women 1 boy does work in 40 days, 1 women in 30 days. 1 boy + 1 women in $17\frac{1}{7}$ days. ANS.

JOHN MOSER, York Mills, N.B.

When going in opposite directions the engine passes the train at a speed equal to sum of the rate of the engine and train, and when going in the same direction the engine passes train at a speed equal to the rate of the engine minus the rate of the train.

∴ Sum of rates of engine and train in 5 sec. is the length of engine plus length of train, or 720 times length in 1 hr.

Difference of rates in 25 sec. is length of engine plus length of train. We have got sum and difference of rates ∴ the rate of faster, which is the engine, is 432 times length of both in 1 hour, which equals 30 miles per hour ∴ length of both is $\frac{30}{1}\frac{5280}{432} = 366\frac{2}{3}$ feet, take away length of engine leaves 336 feet = length of train. $2\frac{1}{2}$ times, No. passed per minute = rate of train in miles per hour. Divide this by the number passed per hour, which is 60 times the number passed per minute, and the result is the distance apart of poles.

Thus—$\frac{5}{2}$ times No. passed per minute. 60 times No. passed per minute = $\frac{1}{30}$ of a mile = 66 yards. IVANHOE.

Literary Review.

The Century for September has for frontispiece a very fine portrait of Gen. Grant, with fac simile of his signature. Among the many contributions by well known writers. The siege of Vicksburg from the "Personal Memories of U. S. Grant," will be sure to be the centre of public interest. "Abigail Becker," by Amanda T. Jones, is a stirring ballad describing the rescue of seven shipwrecked mariners by a Canadian heroine. Among the noticeable articles are "A Silent South" by Geo. W. Cable, "The Great River of Alaska" by Frederic Schwatka, No. 8 of "The Bostonians" by Henry James, and a number of war papers. One of the "Open Letters" is a "Plea for National Aid to Education," by C. N. Jenkins.

In the September ST. NICHOLAS the favorite contributors are well represented. Frank R. Stockton, depicts "The Battle of the Third Cousins." J. J. Trowbridge continues the narrative of "His One Fault," C. F. Holder, describes "The Spiders of the Sea," in an interesting article which is made still more attractive by nine illustrations by J. C. Beard, and J. M. Nugent, Edmund Alton contributes some additional chapters of "Among the Law Makers," Lieut. Frederick Schwatka, gives a seventh instalment of "The Children of the Cold," and a dozen other writers of prose and verse add their quotas in great variety, to make up a taking number of this unique Magazine for the young.

(NOTE.—The price of S. G. Boyd's "Indian Local Names," noticed in these columns a week or two since should have been $1.25, post paid, instead of $1