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# The Canada School Journal.

## AND WEEKLY REVIEW.

VOL. X.

TORONTO, OCT. 15, 1885.

No 37.

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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—T E R M S .—o—

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### The World.

Our portion of Lord Salisbury's recent speech is of special interest to colonies. He declares himself in favor of Imperial Federation, which he says is in accordance with Conservative traditions, and one of the most important questions of the future. He was forced to admit, however, that his plans in regard to the matter had not yet taken tangible shape. This admission, in regard to a matter which has been so long and so much discussed, indicates the great if not insuperable practical difficulties which beset the project. As a subject for practical statesmanship it is clear that the Imperial Federation idea is yet in the clouds, and seems likely to remain there.

The last week has brought rather exciting news from France. The Conservatives, composed of Monarchists, Bonapartists, and other of the almost innumerable factions which make French politics so intricate a study, have made important gains in the recent elections. Three members of the cabinet have resigned in consequence of defeat, and a reconstruction of the

ministry is thus made necessary. It is pretty certain, however, that the Republican party will still remain in the ascendant. Even in case of a temporary defeat of the ministry, there is little probability that the incoherent factions of the opposition could be compacted so as to make administration possible. The chief significance of the electoral vote is no doubt its condemnation of the recent attempts of the ministry to extend the Colonial Empire by conquests in Tunis, Tonquin, and Madagascar. The French are not yet sufficiently versed in the principles of local self-government to make successful colonizers, and the people do not share the ambition of their leaders to work in that direction at such expense to the national purse and reputation.

One of the most disgraceful incidents in colonial history has recently been brought to light in Queensland. A Royal Commission was appointed some months since to ascertain the facts in reference to the alleged kidnapping of South Sea Islanders for work on the sugar plantations. The report of the Commission confirms the charge and reveals a history of fraud, treachery and murder, rivalling in horrible cruelty the worst features of the old African slave trade. The Queensland Government, to its honor be it recorded, has taken prompt action, and done all in its power to atone for the foul crime. The surviving natives to the number of nearly 600 have been sent back to their island homes, with compensation, such as is possible, for their wrongs and sufferings. Compensation (?) has also been made to the relatives of about 100 of the poor creatures who died from exhaustion and ill-treatment during seven months "free voluntary labor," on the sugar plantations. It is to be hoped that the compensation will be exacted from those responsible for this attempt to revive the horrors of the slave trade, and that exemplary punishment will be inflicted upon the leaders.

The great electoral campaign in England has begun in earnest. Mr. Chamberlain and Sir Charles Dilke on the one hand and Lord Salisbury on the other, have made very effective speeches. Mr. Chamberlain has outlined a comprehensive scheme of reform, including radical changes in land tenure, the abolition of primogeniture and entail free schools, &c. Sir Charles Dilke urges the Cabinet to confer upon Ireland the largest measure of self-government compatible with the integrity of the Empire. Lord Salisbury deprecates interference in the affairs of Eastern Roumelia, announcing, nevertheless, that the policy of the Government is to uphold the Turkish Empire, and at the same time, as far as possible, to foster the self-sustained nationalities which are coming to the front, and will have important results in Europe. He favors large changes in Great Britain in the direction of decentralization of authority, and extension of self-government. Parnell, too, has again been heard from. In regard to the two conditions which prominent statesmen have declared must limit concession to the demand for Irish home rule he says in effect, that no pledge

can be given binding the coming Irish Parliament not to protect certain Irish industries against English competition and intimates that the legislative independence demanded for Ireland will, at least, increase the danger of separation and destruction of the British Empire. It is remarkable that the leaders of the two great parties seem to vie with each other in foreshadowing radical reforms. The great English journals on both sides admit frankly the ability and candor of their opponents, a thing that would be an unheard of phenomenon in Canada, where the essence of newspaper political strategy seems to consist in belittling the leaders of the opposite party and their efforts.

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### The School.

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We must crave the patience of the competitors for the Arithmetical Prizes a little, we trust only a little, longer.

We commence in this issue the publication of Dr. Allison's able and suggestive paper, which was promised a week or two since, but has been inadvertently delayed. It will repay careful perusal.

The East Bruce and North Hastings Teachers' Associations are to be held, the former at Warton, the latter at Madoc, on the 15th and 16th inst. The programmes in each case give promise of interesting and useful sessions.

Lord Salisbury has not much faith in free schools. He characterizes Mr. Chamberlain's project as an attempt to overthrow religion and "destroy the Church, the State, and the Schools." What a plight the United States and Canada must be in to be sure, after so many years of the infliction!

The expectations of Canadian geographers will suffer a considerable fall if the report of Mr. Low, of the Dominion Geological Survey, in regard to the size of our great northern "inland sea," Lake Mistassini, be accepted as reliable. Mr. Low has been exploring in that region since March last. He states, as the result, we presume, of actual measurement, that the lake is 125 miles in length by 20 in width. The St. Rupert, a rapid stream with a volume of water almost as large as that of the Ottawa, connects the lake with James Bay. The country is somewhat flat, timbered with small spruce, and not at all adapted to grain-growing on account of frost. The mineral wealth of the district is confined principally to iron, but whether in paying quantities or not is as yet undecided. The only remaining source of doubt, and we do not know whether any room is left for even that, would seem to be as to the possibility of Mr. Low's having mistaken some smaller body of water for the great unknown. We shall probably hear again from Mr. Bignell.

The Baltimore *Herald* gives a tolerably full report of Archdeacon Farrar's address at the opening of the Johns Hopkins University. The eloquent prelate paid a well-merited tribute to the exhaustiveness of the curriculum of that institution. He depicted with his usual rhetorical brilliancy the woful waste of

time under the old English system, which caused seven or eight years of a boy's life to be spent "in *not* acquiring the inflection of a single Greek verb," and allowed him to grow up "in ignorance unfathomable, without a bottom or a shore." He did not fail, however, to do justice to the glorious languages of Greece and Rome, and their unsurpassed value as instruments of thought and keys to the temples in which are stored the choicest treasures of literature. The Archdeacon's peroration on "The Beneficence of Science" was in his most eloquent strain. But the whole address is too good to be lost, and we have clipped it for a future issue.

"Illustrious educators are confined to no particular school or system, and no limitations can prevent a genuine teacher from kindling in the bosoms of his pupils a sincere and ardent love of the truth." The above sentence from Dr. Allison's essay contains a golden principle, which cannot too often be set before the minds of all who are engaged in this noble profession. It embodies two thoughts each of which is of special importance. The one is that the true educator will make his power felt in spite of all restrictions and obstacles; the other that the mark and culmination of his success will be manifest in the ardent and ever-growing "love of the truth" which he develops in his pupils. Dr. Allison does not say, be it observed, "ambition to excel," or even "intellectual power," or "love of knowledge," but "love of the truth." To inspire love of truth for its own sake, not as a means to an end but an end in itself, is the highest goal of the true educator's efforts.

We called attention some time since to a new experiment, which is being tried in some of the German schools, viz.: that of giving the pupils a daily bath. A news item quoted from a contemporary, in another column, indicates that the innovation is likely to prove both useful and popular. It is quite in keeping with the spirit of the times which is recognizing more and more that children have bodies to be cared for, physical organs to be trained, and moral tastes and powers to be cultivated, as well as intellects to be developed. A minor but by no means unimportant benefit of the bath will be its refreshing and stimulating effect. We have no doubt that, other things being equal, a child emerging from a cool bath, will be wider awake, and readier for mental effort, than his unwashed neighbors. Nor will it seem extravagant to those who have been trained to regard cleanliness as next to godliness, to say that the formation of the habit can scarcely fail to have a good moral influence upon the future of the child. Those who are thus taught during their most successful years to enjoy the luxury of conscious cleanliness will not relapse without a struggle into habitual disregard of the bath. A sense of personal cleanliness stimulates self-respect, which manifests itself again not only in neatness of apparel and surroundings but in propriety of deportment. On the score of health, too, there is quite as much to be said in favor of a school bath as of calisthenics, drill, or gymnastics. In all probability the bath-room is coming to take its place as an indispensable adjunct of the school-room, though climatic and economical obstacles may prove serious in a country like Canada.

## AN EVIL AND ITS REMEDY.

Some of the educational journals are protesting against the common practice of school boards in publishing the names of all candidates for positions, the unsuccessful as well as the successful. For every vacancy of any importance in the Public or High Schools there are, it may be, on the average, thirty or forty applicants. In the nature of the case but one can be appointed, and it is certainly an annoyance and humiliation, and often, no doubt, an injury to the defeated candidates, many of whom may possess qualifications equal or superior to those of the appointee, to see their names paraded in the list of the disappointed.

We do not think, however, that the remedy is so simple and easy of application as some of our contemporaries imagine. As a rule, we suppose the board is only indirectly responsible for the publication. The newspaper reporters are the real culprits, if culprits there are. But publicity is one of the essential safeguards of all representative institutions. The only way in which trustees could prevent the publication of the names would be by the exclusion of reporters from their meetings whenever necessary. But the trustees are elected representatives of the people, and the people claim the right of full knowledge of all their proceedings. Public opinion would not long tolerate a board of trustees who should transact their business in secret conclave, and all recorded experience goes to show that public opinion is in the right.

There is a more excellent way, as the *Ohio Educational Monthly* points out. The root of the evil lies too deep to be affected by the reporter's pencil. "It has its origin largely in the willingness of teachers to scramble for places—a practice more unbecoming than that of publishing the names of applicants, betraying a want of delicacy and professional spirit. The experienced teacher should endeavor to get himself into the attitude of receiving rather than making proposals, and boards of education should choose their teachers and invite them to their positions. It is disreputable for a lawyer, a physician, or a clergyman to make direct application for employment, and it ought to be so for the teacher."

All this is very true, and the profession of teaching will never be raised to its proper dignity until such change is brought about. The *Monthly* adds that it devolves upon teachers to educate public sentiment in regard to the matter, and thinks that "one who has occupied a position for one or more terms should not submit to the humiliation of being compelled to make formal application before he can be employed for another term." We do not know to what extent the system of engaging teachers from term to term is in vogue in Canada. We should hope, for the credit of all concerned, that such is not the usual practice. No man can do his best work, or retain the high sense of self-respect which should characterize the members of one of the noblest of professions, so long as he is compelled to go about his duties with the consciousness that his engagement terminates in a few weeks or months, after which he may be unceremoniously dismissed by some needy aspirant or sacrificed to some personal prejudice.

Though the teacher can do much to educate public sentiment to a higher standard, the school boards can, in our humble opinion, do more. For the teacher to determine to make no formal application would often be to vote himself out of the ranks. In many cases his waiting for a call would be about as hopeful a task as that of the famous individual who sat down by the river to wait for the water to pass by. But it is in the power of every school board to inaugurate the practice at will. By a little trouble and enquiry they could always learn of eligible teachers, and if they could but get above the degrading system of seeking to cheapen the work and take advantage of the needy by advertising for "applicants to state salary wanted," they might in a short time effectually cure the evil complained of, and at the same time secure the services of better classes of teachers than the average engaged under the auctioneer system now so much in vogue.

## INDUSTRIAL TRAINING IN THE SCHOOLS.

This subject is just now attracting much attention and there is little doubt that school systems in the more progressive countries are on the eve of important changes in the direction indicated. A thoughtful article in the last number of the *Christian Union* points out that the teaching of industrial drawing in the schools is but laying the foundation, and becomes intelligible and useful only when the pupil begins to work from his own drawings, and that mechanical work in wood and iron becomes far more inspiring when the workman has learned to make his own designs.

The writer goes on to say that while "it is not to be desired that specific mechanical trades should be taught in our public schools," "a general training in the use of the more common working tools, and, in some cases in the simpler operations of the forge and the machine-shop, is practicable and highly desirable. Knowledge of the more common tools, and of the ways of using them; of the elementary mechanical operations; of the common methods of manipulating wood, and perhaps iron—this can be imparted to boys in our schools from fourteen to sixteen years of age, at no great expense, and with the greatest advantage to the boys themselves and to society at large." "This," adds the *Union*, "is no conjecture; the scheme has been worked out in Boston, in Montclair, N. J., in St. Louis, and elsewhere, the experiments now in progress are proving abundantly successful, the thing can be done, and the reasons for doing it multiply and increase in urgency year by year."

The writer goes on to state what we can readily believe, that the boys who give half their time to this kind of work get on with their book studies nearly if not quite as fast as those who give all their time to their books. Mental perception is quickened, the boys almost uniformly delight in the exercise and the moral benefits are clearly marked.

The same course of remark applies with equal force to instruction in sewing, ornamental needle work, modelling in clay and various other of the simpler industrial arts for girls' schools. In regard to both sexes the effect is to dignify and exalt manual

labor, to diversify national industries and to improve the public morals.

As we have before observed, any scheme of the kind adopted in Canada should have, in the case of both boys and girls, particular reference to farming pursuits. Whether it will ever be found practicable to incorporate such industrial training with the public schools proper is, it seems to us, doubtful, notwithstanding the success achieved in a few special cases. But we see no reason why an annex for industrial training should not become in time an adjunct of every public school. The more purely intellectual results would, we believe, be scarcely less satisfactory, and the effect upon national character and morals could not fail to be highly beneficial. The long-apprenticeships of the old days are going or gone. A comprehensive system for training hand and eye and judgment must before long take its place. The deftness and intelligence which a boy or girl thus trained would bring to any chosen art or industry would amply compensate for several years of unintelligent work under a master whose care often is that the apprentice shall not learn too fast.

### Special.

#### ELEMENTARY CHEMISTRY.

##### — CHAPTER IV. SECTION I.

##### NITROGEN.

Symbol, *N*. Atomic Weight, 14. (14.01.) Molecular Weight  
*N*<sub>2</sub>, 28.

##### PREPARATION.

By abstracting the Oxygen from Air.

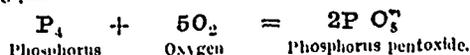
##### 87. By burning hydrogen gas.

**Exp. 1.**—Take a quart bottle of hydrogen, hold it mouth downwards and apply a light to it. Observe that the hydrogen burns only at the mouth of the bottle. When the hydrogen ceases to burn, place the bottle mouth downwards in water till it cools. Observe that the bottle is filled with a colorless gas, otherwise the water would rise in it. Still keeping the bottle inverted, immerse a lighted taper in it; the taper is immediately extinguished, and the gas does not burn. The gas in the bottle must be one of the constituents of the atmosphere. It is called *Nitrogen*. The other constituent, Oxygen, has united with the hydrogen, forming water, which is seen on the inside of the bottle. The nitrogen was heated by the burning hydrogen, becoming lighter and therefore ascending in the bottle, and pressing the hydrogen downwards.

##### 88. By the active combustion of phosphorus,

**Exp. 2.** Cover the bottom of a soup-plate, to the depth of half an inch, with water. Take a piece of chalk or crayon, hollow it out into a little cup, and float it on the water by means of a large flat cork. Into the cup put a piece of dry phosphorus, about the size of a large pea, set it on fire, and cover it with a quart bottle. Keep the hand on the bottle till

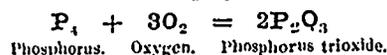
the phosphorus goes out. The phosphorus combines with the oxygen of the atmosphere, forming phosphorus pentoxide,  $P_2O_5$ ; thus:—



The combustion goes on until nearly all the oxygen is removed from the included air. The air is at first expanded by the heat of the flame, and a portion of it escapes from the vessel, afterwards it diminishes in volume as its oxygen is removed, so that it is necessary to pour water into the plate to prevent the external air from passing into the bottle. After a time the white fumes will be absorbed by the water, leaving the enclosed nitrogen quite clear.

##### 89 By the slow combustion of phosphorus in moist air.

**Exp. 3.**—If instead of setting fire to the phosphorus, as in the last experiment, the bottle is simply placed over it, the phosphorus will gradually combine with the oxygen of the air, forming phosphorus trioxide,  $P_2O_3$ ; thus:—



In two or three days all the oxygen will be removed, leaving nearly pure nitrogen, amounting to about four-fifths of the original bulk of the air.

Ordinary combustibles are not available for the preparation of nitrogen for two reasons: (1) They do not remove all the oxygen. (2) They introduce a contaminating gas. Phosphorus has neither disadvantage, and is generally employed.

##### PROPERTIES.

**Exp. 3.**—Place a glass plate under the mouth of the bottle, in the first experiment, and place it on the table, mouth upwards. Plunge a lighted taper into it; the taper is extinguished, while the gas itself does not take fire, thus showing it to differ from oxygen in which the taper continued to burn, and from hydrogen, which extinguished the taper, but was itself inflamed.

Hence, *Nitrogen is neither combustible nor a supporter of combustion.*

**Exp. 4.**—Pour some clear lime-water into the bottle, close it with the palm of the hand, and briskly agitate it; the lime-water is not rendered turbid. *This test serves to distinguish nitrogen from carbon dioxide.*

##### SUMMARY AND ADDITIONAL FACTS.

**90. History.** Nitrogen was discovered by Dr. Rutherford, Professor of Botany in the University of Edinburgh, in 1772. Scheele and Lavoisier independently proved that air was a mixture of the newly discovered oxygen and another gas which Lavoisier named *azote*. This azote, Chaptal in 1789 recognised as a constituent of nitre or saltpetre, and he therefore named it nitrogen. It was liquified in 1878 by a pressure of 200 atmospheres.

**91. Sources.** In nature the great store and source of nitrogen is the atmosphere of which it forms four-fifths. In the mineral kingdom, especially in soils, it occurs in small quantities as an ingredient of saltpetre and of ammonia. It is a small but constant constituent of all plants, and in the animal it is a never-failing component of the working tissues, the muscles,

tendons, and nerves, and is therefore an indispensable ingredient of food. Nitrogen also constitutes an essential part of many of the most potent and valuable medicines, as well as some of the most dangerous poisons, such as quinine, morphine, prussic acid, and strichnine.

92. **Properties.**—Free nitrogen, under ordinary circumstances, has scarcely any active properties, but it is best characterized by its chemical indifference to most other bodies. We have seen that it does not support combustion, neither does it burn. It cannot maintain respiration, so that animals perish if confined to it. Decay does not proceed in an atmosphere of this gas, and in general, it is difficult to effect its direct union with other bodies.

Its specific gravity is .9713; it is therefore a little lighter than air. It is very slightly soluble in water. Being so feebly adapted for combination, most of its compounds are more or less unstable, and many are explosive.

93. **Tests.**—In a free state we know it by its negative character; in combination as nitric acid or as ammonia, it may be recognised by the special tests for these bodies.

**Uses.**—These are confined to Nature as a diluent to air, and as a constituent of tissue.

#### QUESTION ON NITROGEN.

1. How does Nitrogen occur in nature? Mention some gaseous and solid bodies which contain it.

2. When and by whom was nitrogen discovered?

3. How can you obtain nitrogen from atmospheric air? Express the reactions by equations, and give drawings of the apparatus.

4. Describe the characters of nitrogen, and show how it may be distinguished from oxygen and hydrogen.

5. What effect would an atmosphere of nitrogen produce on life and combustion?

(To be continued.)

#### HIGH SCHOOL LITERATURE.

BY J. E. WETHERELL, M.A.

#### FIRST PAPER.

#### Introduction to "Warren Hastings."

[The following introduction to Macaulay's *Warren Hastings* does not appear in the school editions.]

"This book seems to have been manufactured in pursuance of a contract, by which the representatives of Warren Hastings, on the one part, bound themselves to furnish papers, and Mr. Gleig, on the other part, bound himself to furnish praise. It is but just to say that the covenants on both sides have been most faithfully kept; and the result is before us in the form of three big, bad volumes, full of undigested correspondence and undiscerning panegyric.

If it were worth while to examine this performance in detail, we could easily make a long article by merely pointing out inaccurate statements, inelegant expressions, and immoral doctrines. But it would be idle to waste criticism on a bookmaker; and, whatever credit Mr. Gleig may have justly earned by former works, it is as a bookmaker, and nothing more, that he now comes before us. More

eminent men than Mr. Gleig have written nearly as ill as he, when they have stooped to similar drudgery. It would be unjust to estimate Goldsmith by the *History of Greece*, or Scott by the *Life of Napoleon*. Mr. Gleig is neither a Goldsmith nor a Scott; but it would be unjust to deny that he is capable of something better than these memoirs. It would also, we hope and believe, be unjust to charge any Christian minister with the guilt of deliberately maintaining some propositions which we find in this book. It is not too much to say that Mr. Gleig has written several passages which bear the same relation to the "Prince" of Machiavelli than the "Prince" of Machiavelli bears to the "Whole Duty of Man," and which would excite amazement in a den of robbers, or on board of a schooner of pirates. But we are willing to attribute these offences to haste, to thoughtlessness, and to that disease of the understanding which may be called *Furor Biographicus*, and which is to writers of lives what the *goutre* is to an Alpine shepherd, or dirt-eating to a Negro slave."

#### CLASS EXERCISE.

(1) Which is the most appropriate title for this composition, Essay, Biography, History or Critique?

(2) Describe in a sentence Macaulay's estimate of Gleig's Memoirs.

(3) "Undigested correspondence."—How has Macaulay, to prove the guilt of Impey, used one of Hastings' letters, published in the memoirs?

(4) Point out the contemptuous and sarcastic touches in the critical introduction.

(5) "Several Passages..... Whole Duty of Man." Compare with the following as to structure,—“What the Italian is to the Englishman, what the Hindoo is to the Italian, what the Bengalee is to other Hindoos, that was Nuncomar to other Bengalees.” What rhetorical device is employed in both?

(6) "Which is to writers of lives..... slave." Compare with the following as to structure,—“What the horns are to the buffalo, what the paw is to the tiger, what the sting is to the bee, what beauty is to woman, deceit is to the Bengalee.” What favorite rhetorical expedient does Macaulay here use?

(7) "Immoral doctrines." What "Immoral doctrines" does Macaulay accuse Gleig of teaching?

[Besides the passages to be found in the school editions containing strictures on Gleig's ethical notions, two vigorous passages appear in the original article of the *Edinburgh Review*;—one referring to Gleig's description of the conduct of Imhoff; the other relating to Gleig's opinion of Hastings' conduct in connection with the Princesses of Oude, and the two eunuchs, as follows:—

"There is a man to whom the conduct of Hastings, through the whole of these proceedings, appears not only excusable but laudable. There is a man who tells us, 'that he must really be pardoned if he ventures to characterize as something pre-eminently ridiculous and wicked, the sensibility which would balance against the preservation of British India a little personal suffering, which was applied only so long as the sufferers refused to deliver up a portion of that wealth, the whole of which their own and their mistresses' treason had forfeited.' We cannot, we must own, envy the reverend biographer, either his singular notion of what constitutes pre-eminently wickedness, or his equally singular perception of the pre-eminently ridiculous. Is this the generosity of an English soldier? Is this the charity of a Christian priest? Could neither of Mr. Gleig's professions teach him the very rudiments of morality? Or is morality a thing which may be well enough in sermons, but which has nothing to do with biography?"

Never lose a chance of saying a kind word, and when that word is written let it be with an Esterbrook Steel Pen. The stationers supply them.

## ENTRANCE LITERATURE FOR DECEMBER, 1885.

SECOND PAPER, BY THE EDITOR.

## THE FIXED STARS.

Page 93, Ontario Fourth Reader.

"The fixed stars" are not really immovable, as their name implies. This is proved in the case of some of the double stars, described below, by their being seen to revolve either one around the other or both around a common centre.

"The turning vault."—The pupil has, of course, learned that the vault of heaven does not really turn as it appears to do.

"The same instrument" This knowledge is gained by means of a prism—that is, a triangular bit of glass through which a ray of light is let pass and made to fall upon a wall or other surface in a dark room. The prism separates the white ray of light into the rainbow colors of which it is composed. By close examination of the colors comprising this *spectrum*, as it is called, it has been found that the colors are not perfectly continuous, but are crossed by fine dark bands, sometimes countless in number, and still further experiments have proved that these bands vary with the substances composing the flame which transmits the ray, every combustible substance having its own peculiar bands. Thus, when a ray of light of sufficient strength can be had from any star, its *spectrum* can be analyzed, and the scientific experimenter can ascertain what elements are present in the atmosphere of flame which sends the ray.

"These double stars show very pretty colors."—These colors are often what are called "complementary," and it may be that the second is only apparent, *i. e.*, is caused by the action of the first upon the retina of the eye, as illustrated by an experiment with which most children are probably familiar.

Proctor's style is often careless or defective. For instance:—Page 93—"Would not look nearly so bright." No one would say, "Would look nearly so bright," and yet the adverb *not* simply modifies the verb, and should not affect the structure of the sentence. Correct.

"Fiery hot matter"—Does the adjective "hot" add anything to the meaning or force of "fiery"? If not, it is redundant.

Page 94.—"Which are either not present, etc. Let the pupils point out what is wrong in position of "either."

"There seems to be no end to them," *i. e.*, literally to the stars. The author means to their number. This is not hyper criticism, but a question of precision in the use of language.

"Planets."—From a Greek word meaning "to wander," because they are constantly changing their relative position in the heavens. Name the planets.

"Fixed."—Note the prevalent abuse of the meaning of this word in America.

"Pleiades" (*ple-ya-dēz*, or *pli-a-dēz*).—According to one Greek myth these were seven daughters of Atlas, who killed themselves through grief at the death of their sisters, the Hyades, or of their father, and were placed in the heavens as stars, by Jupiter.

"Praesepē" (*pre-sē-pe*).—Properly, a fold or enclosure of any kind.

"Neb'ulæ."—Latin plural of *nebula*, a vapor or mist.

This lesson contains more matter for study than can be properly treated in a single lesson either in the class-room or in this journal. There are many points which could be made interesting to intelligent pupils by means of diagrams on a blackboard and other illustrations. The "turning vault of heaven," the reason why the apparent size of objects diminishes in proportion to distance, the principle of the structure of the telescope, the mode of determining the size and distance of heavenly bodies, the theory of spectrum

analysis, etc., may be suggested as examples. But especially the children should be taught to recognize the constellations referred to, and a few of the most conspicuous planets and stars. A practical lesson of this kind on a suitable night would create a living interest in the book-work, and also constitute a valuable object-lesson, if we may so call it, on the subject of How to Read.

## THE HISTORICAL DEVELOPMENT OF EDUCATION.

BY DAVID ALLISON, LL. D., SUPERINTENDENT OF EDUCATION FOR NOVA SCOTIA.

It is scarcely necessary to remind such a body as the Ontario Teachers' Association that it is not my purpose to enter upon an exhaustive, closely-reasoned discussion of the subject which has been announced. The discursive observations I have to offer proceed from convictions that the impotence of the inductive study of education has not been duly estimated even by many of those who are laboring for the elevation of educational ideas and the improvement of educational methods; and that, by simply commending it to their attention, I may render a service to the younger members of your learned association.

No feature of the intellectual activity which marks our age is more obvious than the disposition to trace historical growths from their "primordial gems" to their latest and completest developments. No variety of social, political, or ecclesiastical institution; no law, custom, language, or creed, escapes this careful, microscopic process of investigation. Darwin in the "Development of Species," and Newman in the "Development of Dogma" alike impressively testify to the prevailing tendency of modern thought. It is altogether vain to deride this tendency as a mere idiosyncrasy, always unprofitable, often irreverent. Undoubtedly a rash and restless spirit of inquiry has sometimes yielded to a temptation to transgress the legitimate boundaries of human knowledge, but, on the whole, we find the impulse to historical research springing from worthy motives and permanently enriching mankind by its results. Even inquiries which, through misdirection, or otherwise, have failed of their main object, not infrequently issue in incidental good of equal or greater value.

In everything the present bears some relation to the past, and the more important any given thing may be, the greater need that we should know just what that relation is. To some extent the history of education is involved in the history of literature, in the history of science, in the history of civilization itself: for in a broad sense each age, in its scientific spirit, in its general culture, is just what the methods of education in vogue have made it. Yet we are to remember that education has a history of its own; that it is something distinct from literature and science and civilization; that it is at once an historical entity and a science, whose principles can be learned only by careful research and induction, while their application to the complex social and industrial conditions of modern life involves many difficult and as yet unsettled problems. What worthier task, therefore, can we propose to ourselves than that of tracing its development from the rude embryonic studies of primitive times down to the highly organized systems and artistic methods which have been elaborated during the course of centuries?

That word of caution, which is always necessary when a matter of historical inquiry is proposed, is necessary here. Indeed, from its relation to religious controversies and political strifes, education is one of those subjects which men are peculiarly apt to look at through distorting media. It can therefore claim with the strongest logical emphasis that we shall study its history with that calm dispassionate willingness to abide by results, which is the only true spirit of scientific investigation. We must learn that the sole legitimate aim of historical inquiry is a true knowledge of the real past, that he does not deserve to be called a student of history, whose aim is less comprehensive and complete than this. To attempt to elucidate contemporary educational problems by researches conducted on the principle of seeing nothing that makes against our preconceived notions and magnifying everything that seems to sustain them, is to do violence to the first principles of the historical method. It is to degrade our inquisitive faculty from one of its noblest and most fruitful uses, and make it the instrument of a blind, selfish and dishonorable partisanship. To study education

inductively with profit, we must have the temper of the ideal geologist, who raises his hammer to strike without knowing whether the descending blows will confirm his antecedent theory or shiver it to atoms, and without *cautela*, his sole anxiety being to learn concerning the matter in hand "the truth, the whole truth, and nothing but the truth." But a mere ascertainment of objective fact by no means exhausts the duty of a student of the history of such a subject as education. Facts require *interyrelation*. Their true significance is learned only by the evolution of the motive-forces which have produced them. Events must be placed in such a relation to each other as the laws of historical perspective require. In regard to education as in regard to everything that has taken shape under the free play of human motive and volition, we must struggle against and overcome the conviction (almost invincible though it be) that that which long has been is that which ought to be now. We must not, in the servile spirit of mere copyists, search simply for models of imitation. The instruction we seek the past must be such as its history affords, when read, studied, and valued with both intelligence and honesty.

Pursued in such a spirit as I have thus briefly indicated, the study of educational development must be irenic in its effects. We shall learn to reverence the genius of true scholarship, wherever and by whomsoever displayed. We shall learn that the precious fruits of knowledge grew on many trees with roots in many soils. We shall learn that illustrious educators are confined to no particular school or system, and that no limitations can prevent a genuine teacher from kindling in the bosoms of his pupils a sincere and ardent love of the truth. Above all, we shall learn to distinguish between the transient and the permanent in the elements and instruments of education. A recognition of the analogy between the intellectual and the spiritual development of our race will recall the language of a sacred writer, "Now this word *signifieth* the removing of things that are shaken as of things that are made, that the things which *cannot be shaken* may remain."

But I must dismiss the general question thus opened up as including too much for satisfactory treatment in such a paper as this. Let me simply raise a few inquiries as to the light shed by the history of education on some of the debatable questions of our own day.

1. *What subjects shall be taught in our schools and colleges?* This is a question of the utmost importance, yet it receives a perplexing variety of answers, a variety corresponding to the different theories that are held in respect to the true end of education. One school, ably represented by the learned essayist\* who has preceded me, seeks an answer to the question asked by an analytic inquiry into the effects of education upon character. With another school the primacy of studies is determined by its fundamental conception of education as an agency for sharpening faculty and developing mental power in a general sort of way, for producing that nameless grace, that undefinable charm of scholarship, which for lack of a better term men have to call "culture." Those who hold this to be the highest and best type of learning place their chief reliance for its production on those studies which, from resting on human speech, opinion, and history as their basis, are known as "the humanities." The upholders of this theory of education refer us to illustrious lines of statesmen and jurists, of poets and philosophers, as at once its product and its vindication. But what can be more emphatic than the repudiation of this whole theory and all that it involves by many modern educationists? These tell us that the true aim of education is to fit our youth directly for the practical responsibilities and duties of citizenship and life, and that this fact should give direction to the studies of both school and university. They represent the world we live in as quite as well worth studying as the buried nations and extinct civilizations of the past, while they reject, as founded on a monstrous misconception, the usage which limits the name of *scholar* to the man who has spent his lifetime in the analysis of words and the generalization of abstractions. This view of education is supported by Dr. Arnold's well known sentiment, that "in whatever it is our duty to act, these matters also it is our duty to study," a sentiment which after all is but the echo of the voice of the ancient sage, "Teach your son while a boy what he will have to practice when a man." These advocates of a practical *cultus*, also, are not afraid to appeal to fact in support of their contention, claiming that so large a percentage of the representatives of so-called "culture" fail to be of any recognizable service to the world, as to

excite a suspicion that the humanistic studies got a good deal of undeserved credit through the fallacy known in logic as "*non causa pro causa*." Nor should we fail to note that scientific and kindred studies are no longer pressed on the severely practical ground of their utility; it is contended that they have proved themselves admirable means of mental discipline, developing powers of intellect and habits of thought but partially reached by the researches of philology, the deductions of mathematics, or the speculations of philosophy.

This is by no means a vivid and realistic picture of the educational strife that is now in progress. Much heat has been imported into the dispute. The battle of opinion is a fierce one, while, to use a popular phrase, it is waged "all along the line." Then we must remember that within the generic controversy there are many minor contentions exciting almost equal interest. A large section of the friends of polite studies have abandoned, in whole or part, their reliance on the ancient classics, and prefer to look for literary inspiration to our mother tongue and the noble literature which it enshrines. Then, too, in the wrangling of theorists, science is pitted against science, while some extremists even urge that science itself is vain unless we teach also the practical arts which are based upon it.

Now, if we ask what help to a satisfactory settlement of the questions in dispute a study of the history of education afford, we must candidly reply that directly, and in regard to matters of detail, it can afford but little. The amount of truth contained in each of the conflicting representations to which I have alluded—for that each contains a certain measure of truth is beyond all question—is a matter depending more on absolute mental law and relations than on what men have thought and done about studies in the past.

Still the law of the development of education, intelligently apprehended, teaches an important lesson which we should be slow to forget. The great educational problem of our day may be fairly stated in general terms to refer to the *relative position to be assigned to the new studies and the old*. The voice of history may be silent as to the comparative value of these studies, but it loudly proclaims the principle that no study can depend on mere prescription for a permanent place among the educational agencies of mankind. Each age is called on to perform its own task, for which it must seek out its own methods, so often as traditional ones prove ineffective or inappropriate. This law can be traced in education as clearly as in every other sphere of thought and effort. We, of course, recognize that principle of inertia which in mental movements always keeps effects from immediately following the causes; but, making due allowance for its operation, we find that the studies of any particular epoch are irresistibly determined by the existing conditions of social, industrial, and intellectual life.

(To be continued.)

## DIVISIONS OF TIME.

By J. ASHER.

In nature time is measured by the motions of the celestial bodies. A year is the time the earth requires to travel round the sun. A month is little more than the time occupied by the moon in its journey round the earth. The week is nearly the time of a moon's quarter. A mean solar day is the average time that passes between the transits of the sun across a meridian. A sidereal day is the time the earth requires to turn once on its axis. It is determined by the apparent motion of the stars, and it is 3 min. 56 sec. shorter than the mean solar day.

The year contains nearly  $\frac{1}{4}$  of a day more than 365 as usually given in the calendar. But were the fraction not reckoned in 751 years the summer solstice would be December 21, and the winter solstice June 21. The error amounts to almost a day in 4 years, and to partially correct it we add one day to the calendar. February was formerly the last and shortest month, hence the leap day was given to it. But there is still an error, for the year contains 11 min. 12 sec. less than 365  $\frac{1}{4}$  days. To partially correct the excess one leap day is omitted at the ends of three-fourths of the centuries. If the first two figures of a centuria or the last two figures of any other year are divisible by 4 it is leap year. Thus 1600 was leap year for 16 is divisible by 4; 1884 was leap year, for it is divisible by 4. The year 1885 is not leap year because a number remains when 85 is divided by 4. The remainder shows that 1885 is the first after leap year.

\* Very Rev. Provost Body.

January was named from Janus, an old Italian deity, the god of the sun and the year. February is derived from *februare*, to purify. In this month was the feast of expiation. March—from Mars, the god of war. April—from *aperire*, to open. In this month the earth opens for new vegetation. May was named in honor of the goddess Maia, daughter of Atlas and mother of Mercury. June from the goddess Juno, wife and sister of Jupiter. July was named in honor of Julius Cæsar. August from Augustus Cæsar. September is derived from *septem*, the Latin for seven. The year formerly began in March, hence September was the seventh month. October from *octo*, eight. November from *novem*, nine. December from *decem*, ten.

The week days were named in honor of ancient deities:—  
 Sunday, in honor of the sun.  
 Monday, in honor of the moon.  
 Tuesday, from Tui, a Gothic hero.  
 Wednesday, from Woden, a Gothic god.  
 Thursday, in honor of Thor, chief god of the Goths.  
 Friday, from Freya, wife of Woden.  
 Saturday, in honor of Saturn, father of Jupiter.

The day of the week for any date in this century may be found by the following rule: Add together the last two figures of the year, their integral fourth part, the day of the month, and the index for the month. Divide the sum of these numbers by 7, the remainder is the number of the week day. Here are the indices for the months:—

January, 3.	April, 2.	July, 2.	October, 3.
February, 6.	May, 4.	August, 5.	November, 6.
March, 6.	June, 0.	September, 1.	December, 1.

In leap year the numbers for January and February are 2 and 5 respectively.

Example 1.—What day of the week was June 18, 1815—the date of the battle of Waterloo?

Solution: Year..... 15  
 Fourth part of 15 without remainder.. 3  
 Day of the month..... 18  
 Number for June..... 0  
 7 | 36

Ans.— 5-1

The remainder indicates the first day of the week, which is Sunday.

When there is no remainder Saturday is indicated. It is the seventh day of the week, and we never get 7 for remainder because we divide by it. Days of the week in last century may be found by adding 2 before dividing.

Example 2. What day of the week was July 4, 1776?

Solution: Year..... 76  
 Fourth part of 76..... 19  
 Day of the month..... 4  
 Number for July..... 2  
 Number for last century..... 2  
 7 | 103

14-5

Ans. The fifth day of the week—Thursday.

A reform in the method of timekeeping had long been desirable, especially in relation to the running of railway trains. Until November 18, 1883, about 50 different standards of time were used by the railway companies of our continent. The continent is now divided into gussets of 15 degrees of longitude each or one hour of time. The meridian that passes through the centre of the great transit instrument in the national observatory at Greenwich, England, is the zero whence these degrees are reckoned. All who reside in our gusset should use time of the 75th degree of W. longitude which is exactly 5 hours slower than Greenwich mean solar time. Those who live in the next gusset west use time of the 90th degree, therefore their time is 6 hours slower than that of Greenwich.

There are five gussets. Those who reside in the farthest east are said to use *Intercolonial time*; those in the second gusset west, or that in which most of the inhabitants of Ontario, Quebec, and the eastern States live, are said to use *Eastern standard time*, the west use *Central standard time*; still farther west they have *Mountain time* and in the last gusset they have *Pacific time*. Thus the railway companies have only 5 standards instead of 50, and each standard differs from the adjacent one by one hour, so that there are no odd

minutes to be reckoned in comparing one standard with another. Should a person travel from Nova Scotia to California he would be able to tell the time at the latter place without setting his watch. If his time-piece indicated Intercolonial time he would need to add 4 hours to the reading of the watch in order to get Pacific time, which they use in California. Time is saved, and railway accidents, due to faulty reckoning, are not so likely to happen as formerly. One disadvantage is noticeable, that is, the standard time cannot be obtained from a noon mark unless the longitude of the place is known. The great reform is said to be due chiefly to Sandford Fleming, Esq., of Halifax, N. S.

Coldstream, Middlesex Co., Ont., August 7, 1885.

Examination Papers.

EDUCATION DEPARTMENT, ONTARIO.—JULY EXAMINATIONS, 1885.

FIRST CLASS TEACHERS—GRADES A AND D.

TRIGONOMETRY.

Examiner—J. A. McLellan, LL.D.

NOTE.—75% reckoned a full paper.

1. Express all the ratios of an angle in terms of the sine, and show how to construct an angle of given ratio, e.g., whose sine is  $\frac{a}{b}$ .

Show that  $(\sec^2 \alpha - \cos^2 \alpha)(\operatorname{cosec}^2 \alpha - \sin^2 \alpha) = 2 + \sin^2 \alpha \cos^2 \alpha$ .

2. Obtain sines of 30°, 18°, 45°.

$ABC$  is a triangle,  $\sin(A-B) = \frac{1}{2}$ ,  $\cos C = 0$ ; find  $A, B, C$ .

3. Show that  $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy}$ ; and that  $\sin n\theta = 2 \sin(n-1)\theta \cos \theta - \sin(n-2\theta)$ .

4. Prove:

(1)  $\tan 70^\circ + \tan 20^\circ = 2 \sec 5^\circ$ .

(2)  $\frac{\sin 3\theta - \sin \theta}{\sin 5\theta - \sin 3\theta} = \frac{\cos 2\theta}{\cos 4\theta}$

(3)  $\frac{\sec A - \sec B}{\operatorname{cosec} A - \operatorname{cosec} B} + \tan \frac{A+B}{2} - \tan A \tan B = 0$ .

5. Investigate the formula  $\Delta S = \{s(s-a)(s-b)(s-c)\}^{\frac{1}{2}}$  If  $a=b$  prove

(1)  $\sin A = \frac{\sqrt{4a^2 - c^2}}{2a}$  (2)  $a = \frac{c \cos A}{1 - \cos B}$

(3)  $S = a^2 \sin A \sin \frac{C}{2} = \frac{c\sqrt{4a^2 - c^2}}{4}$

6. Prove (1)  $\frac{a-b+c}{a+b-c} = \frac{\sin A - \sin B + \sin C}{\sin A + \sin B - \sin C}$

(2)  $\frac{\cos A}{\sin B \sin C} + \frac{\cos B}{\sin C \sin A} + \frac{\cos C}{\sin A \sin B} = 2$

(3) If  $D$  be the middle point of  $BC$ , and  $AE$  perpendicular to  $BC$ , then  $DE = \frac{b \cos C - c \cos B}{2}$

7. Find the radii of the circles which touch one side of a triangle and the other two produced.

Prove (1)  $4R \cos \frac{C}{2} = (a+b) \sec \frac{A-B}{2}$

(2)  $\frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} = \frac{1}{r}$

(3)  $\frac{r_1+r}{r_1-r} + \frac{r_2+r}{r_2-r} + \frac{r_3+r}{r_3-r} = 2$ .

8. If  $\alpha, \beta, \gamma$  be the distances of the centre of the inscribed circle from the angles, prove

$\alpha \beta \gamma = abc \tan \frac{A}{2} \tan \frac{B}{2} \tan \frac{C}{2}$ .

9. From the top of a cliff 100 yards high, the angles of depression of the top and bottom of a vortical river-bank opposite, are  $38^{\circ} 39' 36''$  and  $51^{\circ} 20' 24''$ . Find the breadth of the river and the height of the bank. Given  $\log 2 = .30103$ ,  $\log \tan 38^{\circ} 39' = 9.902928$ ,  $\log \tan 38^{\circ} 40' = 9.903198$ .

10. Solve

(1)  $\cos 2\theta + \cos 4\theta = 2 \cos 3\theta$ . (2)  $1 + \sin x = \frac{2}{3} \cos x + \frac{5}{3} \tan x$ .

(3) If  $\tan \theta = \tan^{\frac{1}{2}} \phi$  and  $3 \cos^2 \phi = m_2 - 1$ , then  $\cos^{\frac{2}{3}} \theta + \sin^{\frac{2}{3}} \theta =$

$$\left(\frac{2}{m}\right)^{\frac{1}{3}}$$

11. A man stands on a wall of height  $h$ , and observes the elevation of (a) top of a telegraph pole; he then descends from the wall and observes the elevation ( $\beta$ ). Show that the height of the post exceeds that of the man by  $\frac{h \sin \beta \cos \alpha}{\sin(\beta - \alpha)}$ .

12. If  $A + B + C + D = 360^{\circ}$ , then

$$\sin 2A + \sin 2B + \sin 2C + \sin 2D + 4 \sin(A + B) \sin(A + C) \sin(A + D) = 0.$$

13. Prove Demoivre's Theorem.

Show how to express an imaginary quantity by means of Trigonometrical functions. Find the three values of  $(-1)^{\frac{1}{3}}$ .

14. Express the Sin and Cosin of an angle in terms of its circular measure.

15. Sum the sines

(1)  $\frac{\cos \phi}{1} + \frac{\cos^3 \phi}{2} + \frac{\cos^5 \phi}{3} + \dots$

(2)  $\sin a - \frac{1}{2} \sin 2a + \frac{1}{3} \sin 3a - \frac{1}{4} \sin 4a + \dots$

(3)  $\sin^{\theta} \left(\sin \frac{\theta}{2}\right)^2 + 2 \sin \frac{\theta}{2} \left(\sin \frac{\theta}{4}\right)^2 + 4 \sin \frac{\theta}{4} \left(\sin \frac{\theta}{8}\right) + \dots$

16. In any triangle

$$\frac{1}{a} \cos^2 \frac{A}{2} + \frac{1}{b} \cos^2 \frac{B}{2} + \frac{1}{c} \cos^2 \frac{C}{2} = \frac{(a+b+c)^2}{4abc}$$

ALGEBRA.

Examiner—J. A. McLellan, LL.D.

NOTE.—75 per cent. reckoned a full paper.

1. Reduce the following to a single fraction:—

$$\frac{a}{(a-b)(a-c)(x-a)} + \frac{b}{(b-a)(b-c)(x-b)} + \frac{c}{(c-a)(c-b)(x-c)}$$

and find the value of

$$\frac{\sqrt{(a+bx)} + \sqrt{(a-bx)}}{\sqrt{(a+bx)} - \sqrt{(a-bx)}} \text{ when } x = \frac{2ac}{b(1+c^2)}$$

2. If the  $f(x)^n$ ,  $\phi(x)^m$  ( $n$  not less than  $m$ ) are equal for more than  $n$  different values of  $x$ , they are equal for all values, and the coefficients of equal powers of  $x$  in each are equal to one another.

Determine the value of

$$\frac{b+c+d}{(a-b)(a-c)(a-d)} + \text{three similar terms.}$$

3. If  $\frac{A+B+C}{abc} = \frac{A}{a} + \frac{B}{b} + \frac{C}{c}$

and  $(A+B+C)(a+b+c) = Aa + Bb + Cc$ ,

then will  $\frac{A}{1+a^2} + \frac{B}{1+b^2} + \frac{C}{1+c^2} = 0$ .

4. Prove that  $x^4 + px^3 + qx^2 + rx + s$  is a perfect square if  $p^2 = r^2$ , and  $q = \frac{p^2}{4} + 2\sqrt{s}$ .

5. Solve

(1)  $a^2 + a^2x + ay + z = 0$   
 $b^2 + b^2x + by + z = 0$   
 $c^2 + c^2x + cy + z = 0$

(2)  $n\sqrt{1+x} - n\sqrt{1-x} = \sqrt{(m^2+n^2)}$ .

In the case of (2) explain fully the difficulty that only one of the values found for  $x$  satisfies the equation.

6. Eliminate  $x, y, z$ , from

$$(y+z)^2 = 4a^2yz, (z+x)^2 = 4b^2zx, (x+y)^2 = 4c^2xy.$$

7. Show that the successive convergents of a continued fraction approach more and more nearly to the true value of the fraction.

Prove that  $\frac{p}{q} \times \frac{p'}{q'} > x^2$ , as  $\frac{p}{q} > x$ .

8. If  $p+y+z=xyz$ , or if  $yz+zx+xy=1$ ,

then will  $\frac{2x}{1-x^2} + \frac{2y}{1-y^2} + \frac{2z}{1-z^2} = \frac{2x}{1-x} \cdot \frac{2y}{1-y} \cdot \frac{2z}{1-z}$

9. The value of a determinant will not be altered if the columns be written in order as rows, and vice versa.

If two determinants  $\Delta$  and  $\Delta'$ , of the  $n^{\text{th}}$  degree be such that the first row of the one is the same as the last row of the other, the second row of the one the same as the  $(n-1)^{\text{th}}$  row of the other, the third row of the one the same as the  $(n-2)^{\text{th}}$  row of the other, and so on, then will

$$\Delta = (-1)^{n(n-1)} \Delta'$$

10. Prove (1)

$$\begin{vmatrix} x & y & z \\ z & x & y \\ y & z & x \end{vmatrix} = \begin{vmatrix} x & y & z \\ 1 & -1 & 0 \\ 1 & 0 & -1 \end{vmatrix} \times \begin{vmatrix} x & y & z \\ 1 & -w & 0 \\ 1 & 0 & -w \end{vmatrix} \times \begin{vmatrix} x & y & z \\ 1 & -w^2 & 0 \\ 1 & 0 & -w^2 \end{vmatrix}$$

in which  $w^2 + w + 1 = 0$ .

(2)  $\begin{vmatrix} (a+b)^2 & c^2 \\ a^2 & (b+c)^2 \\ b^2 & (c+a)^2 \end{vmatrix} = 2abc(a+b+c)^3$

11. In how many orders can  $m$  positive units and  $n$  negative units be arranged so that the sum to any number of terms may never be negative. ( $m > n$ ).

12. Sum the terms  $1 \cdot 2 \cdot 3 \cdot 8 + 2 \cdot 3 \cdot 4 \cdot 9 + 3 \cdot 4 \cdot 5 \cdot 10 + \dots$ , to  $n$  terms, and  $\frac{4}{2 \cdot 3 \cdot 4} + \frac{7}{3 \cdot 4 \cdot 5} + \frac{10}{4 \cdot 5 \cdot 6} + \frac{13}{5 \cdot 6 \cdot 7} + \dots$  to  $n$  terms and to infinity.

13. Determine the coefficient of  $x^r$  in the expansion of  $(1+x)(1+cx)(1+c^2x) \dots$ ; the number of factors being unlimited and  $c$  less than unity.

14. Show that  $1 + \frac{2^3}{|2} + \frac{3^3}{|3} + \frac{4^3}{|4} + \dots = 5e$ .

15. Solve (1)  $(x+y)(x-y) = 40$ ,  $\frac{x+y}{x-y} = \frac{145}{x^2+y^2}$

(2)  $\frac{x^2+y^2}{x+y} = \frac{a^2+b^2}{a+b} = \frac{x^4+y^4}{x^2+y^2} = \frac{a^4+b^4}{a^2+b^2}$

(3)  $(1+x^2)^2 = 2ax(1-x^2)$ .

16. If  $a_0, a_1, a_2, a_3, \dots$  be the coefficients in order of the expansion of  $(1+x+x^2+\dots+x^n)^n$ , prove that

(1)  $a_0 + a_1 + a_2 + \dots + a_{nr} = (r+1)^n$   
 (2)  $a_1 + 2a_2 + 2a_3 + \dots + nra_{nr} = \frac{1}{2}n(r+1)^n$ .

ANALYTICAL GEOMETRY.

Examiner—J. A. McLellan, LL.D.

NOTE.—80 per cent. of this paper will be reckoned a full paper.

1. Show how to transform an equation from one pair of axes to another with the same origin.

If  $(x, y)$ ,  $(x', y')$  be the coordinates of a point referred to rectangular and oblique systems with the same origin, and if the axes of the first system bisect the angles between those of the second, prove that

$$x = (x' + y') \cos \frac{\omega}{2}, y = (x' - y') \sin \frac{\omega}{2}.$$

2. Obtain the equation to a straight line in the form  $x \cos a + y \sin a = p$ .

Find the condition that the intersection of  $x \cos a + y \sin a = p$ ,  $x \sin a + y \cos a = q$ , should lie on the straight line which joins the points (2, 3), (3, 2).

3. Find the coordinates of the point of intersection of the lines  $\frac{2a}{r} = \cos \left(\theta - \frac{\pi}{2}\right)$ ,  $\frac{a}{r} = \cos \left(\theta - \frac{\pi}{6}\right)$ , and the angle between the lines.

4. Find the equation to a circle, the axes being inclined at an angle  $\omega$ .

If  $m^2(x+y-m)^2 = 2r^2xy$  represent a circle, determine the radius, the centre, and the angle between the axes.

5. Taking the pole at a distance  $c$  from the centre of a circle of radius  $a$ , find the equation to the circle.

Find the equation of the chord joining two points  $(\alpha, \beta)$  on the circle  $r = 2a \cos \theta$ .

6. Find the condition that the straight line  $x \cos \alpha + y \sin \alpha = p$  should touch the circle  $x^2 + y^2 = 2(ax + by)$ .

7. Find the equation to the normal at any point of a parabola. Find the locus of the intersection of normals at the extremities of the focal chords of the parabola  $y^2 = 4ax$ .

8. Investigate the equation of the ellipse in the form

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

If  $(x_1, y_1)$  be the coordinates of the middle point of a chord of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , show that the equation of the chord may

be written  $\frac{xx_1}{a^2} + \frac{yy_1}{b^2} = \frac{x_1^2}{a^2} + \frac{y_1^2}{b^2}$ .

9. Investigate the equation of the tangent of a hyperbola referred to its asymptotes as axes.

If two tangents be drawn to a hyperbola, and the points in which they intersect the asymptotes be joined, the joining lines will be parallel.

10. Discuss the results in the equation  $Ax^2 + 2Bxy + Cy^2 + 2Dx + 2Ey + F = 0$ , when one or more of the constants vanish.

Consider the meaning of the following equations and trace, without finding the axes, the lines they represent:—

(1)  $y^2 - 4xy + 4x^2 + 6x - 3y = 0$ .

(2)  $2xy = x + y$ .

(3)  $2(x^2 + y^2) = (x + y - 2)^2$ .

11. Explain the eccentric angle of a point  $P$  on an ellipse.

Obtain the equation of a chord in terms of the eccentric angles of its extremities.

12. Determine the point at which the straight line  $\frac{x}{a} + \frac{y}{b} = \frac{1}{2}$

is tangent to the parabola  $\sqrt{\frac{x}{a}} + \sqrt{\frac{y}{b}} = 1$ .

13. Show that if a circle be described about the triangle formed by a tangent and asymptotes of  $xy = c^2$ , the locus of its centre is  $(x + y \cos \omega)(y + x \cos \omega) = c^2$ , where  $\omega$  is the angle between the asymptotes.

14.  $ABC$  is a triangle inscribed in a circle; from any point  $O$  in the circumference, perpendiculars are drawn to  $OA, OB, OC$ , meeting  $BC, CA, AB$ , in  $D, E, F$ , prove  $D, E, F$ , are collinear with the centre of the circle.

their love for decorative art by collecting fossil shells and colored pebbles, which they drilled and strung together into rude necklets, often not without considerable display of simple taste. Though they did not know the use of metals, and had no tools except roughly chipped bits of flint, yet their stone arrow-heads and lances are often very prettily shaped, while the materials in many cases are carefully chosen from red jasper, or other clear and brightly-colored stone. Their bone harpoons are well and regularly cut, and the barbs are neatly arranged on either side with a perfect symmetry which distinctly marks artistic care. Moreover, several necklaces have been discovered made of the large and smooth teeth of animals, on the sides of which have been carved the figures of seals or bears. When we recollect that all their more perishable products, such as skin coats, baskets, or stained woodwork, must long since have decayed in the moist earth, we can see at once that even amongst these very ancient cave-men decorative art had already developed considerably. But the imitative arts of the cave-men were even more remarkable than their decoration. We possess several excellent bits of drawing or sculpture left behind by this early race in its refuse heaps. Most of the specimens of early artistic effort are figures of animals, roughly scratched with flakes of flint on fragments of reindeer horn or mammoth tusk, as well as on the flat stone known as schist. One such drawing represents the extinct mammoth itself, engraved on a piece of his own ivory—a huge hairy elephant, with long curved tusks and stout trunk. Another shows us the ibex, with his graceful horns; while a third depicts the naked hunter himself, creeping up to a herd of wild bulls. Reindeers, however, form the commonest subjects, and they are sometimes treated with real spirit. For the most curious things about these very early human sketches is this—that they are not stiff, constrained, and lifeless, like the animals drawn by our own children and by most modern savages. One sketch of a reindeer feeding among tall grass, discovered in a French cavern, might almost be taken for a rough study by a very young artist amongst ourselves. The high quality of artistic freedom is found already in the bud in these primeval works.—*Cassell's Popular Educator*.

## Educational Notes and News.

The Board of Trustees of Cornell University have made an appropriation of \$1,600, to complete electrical apparatus on a large scale for the measurement of large electric currents. These experiments are considered of great importance, and Professor Anthony, the Dean of the department of Physics, will be assisted by prominent scientists from different educational institutions in the country. The experiments will be made during the summer.—*Buffalo Express*.

A committee of the London School Board complains of the destruction of property near the schools by schoolboys, and has passed a resolution calling the attention of the head master of the Central School to the matter, and requesting him to see that the rules of the Education Department are carried out. Commenting on the matter, the *Free Press* observes that it appeared from the statements made to be more of a policeman's or detective's duty than that of a teacher that he wanted the school masters to do. This raises an important and difficult question as to the limits of a teacher's duty and authority.

R. R. Cochrane, B. A., honor man of the class of 1885 (Tor.), is now Principal of Port Arthur Public Schools, at a salary of \$1,000.

Mr. A. C. McKay, gold medalist in Physics (Tor.), is the new mathematical master in Port Hope High School.

Mr. Irwin, one of the successful candidates at the late 1st Examination, and now at the Toronto Normal School, is President of the Normal School Literary Society for this term.

Mr. J. G. Carruthers, of Stracey, county of Haldimand, has resigned his position to take up the study of medicine. He is succeeded by Mr. J. Murray, of Caledonia, late of Ottawa Normal School.

## For Friday Afternoons.

### THE ART OF THE CAVE MEN.

FOR TALKING ABOUT.

There never was a time, since man first inhabited the earth, when men were entirely ignorant of art. As soon as we find any evidence whatever of man's presence in the world, we also find evidence of several early arts. The oldest human remains in Europe are those of the French and English caves. These caves were inhabited by men at a time when the climate of Northern Europe was far colder than it is at present; when wild reindeer roamed over the plains of the Thames and the Seine; when lions, hyenas, and mammoths lurked about our hills, and when the hippopotamus still basked during the brief summer in the waters of our rivers. The relics of this ancient race are now dug up from under the solid floor of the caverns in which they lived at so remote a period; yet even in these earliest known human dwellings we find abundant signs of varied artistic tastes. Not only do we discover among their remains the beautifully polished bone needles with which they sewed together their coats of fur, and the red clay which they employed to paint their bodies and perhaps their basket-work, but we also find primitive works of sculpture drawing which would not wholly disgrace a modern European hand. The men of the reindeer period showed;

Mr. G. W. Holman has been re-engaged as teacher for the Winchelsea school for next year. This will be his sixth year. This speaks well for our friend, and goes to show that he must be an able teacher and is giving good satisfaction.—*Exeter Times*.

School Boards throughout the province are very generally taking advantage of the provision in the School Act empowering them to provide for the election of trustees by ballot, and for holding the polling on the same day as the municipal elections are held. Listowel and Parkhill were the last to fall into line. Sarnia should extend the ballot to trustee elections without further hesitation. There is no valid reason for holding trustee elections under a system that no one would want to see applied to our municipal or parliamentary elections.—*Sarnia Observer*.

The next half-yearly meeting of the West Middlesex Teachers Association will be held in the basement of the Front street Methodist Church, Strathroy, on Thursday and Friday, October 16th and 17th.

Bathing in Public Schools is the latest pedagogic innovation in Germany, which has received the hearty approval of Dr. Koch, the Professor of Hygiene in Berlin, and of Prince Albrecht, who thinks this procedure "has a great future." The Burgomaster of Göttingen informs the Berlin *Tagblatt* of September 13 that when bathing was first introduced in the Public Schools of that town, only a few of the pupils availed themselves of the privilege, whereas now 500 out of 700 gladly take part in it several times a week. The children are bathed in sections of six to nine, and as they immediately return to the school-room and resume their lessons, no risk of catching cold is ever incurred; while the refreshing influence of the bath shows itself in a greater energy and eagerness to study. And in the homes of the poorer children, too, their new habits of cleanliness are already exercising a most beneficial influence.—*London Free Press*.

Mr. J. P. Kennedy, of Thorndale, has been, re-engaged for the coming year, at a large increase of salary, as Principal of the Edgcombe Public School. Mr. Kennedy has been successful in his profession, and deserves a good situation.—*London Free Press*.

Kensington school was visited last week by Chief Superintendent Montgomery, who found it making very gratifying progress under the efficient direction of Mr. John A. Matheson, the popular teacher.—*Summerside P. E. I., Journal*.

Miss Alice B. Jordon, of Coldwater, Mich., a graduate of the academic and law department of the University of Michigan, has entered the Yale law school, in New Haven. She is the first lady ever entered in any department of Yale outside of the art school.

The attendance at London Collegiate Institute for last month was 254, of who 119 were boys and 135 girls; daily average, 205.

The next Entrance Examination to High Schools and Collegiate Institutes will be held on Monday, Tuesday, and Wednesday, December 21st, 22nd, and 23rd, 1885. Following is the time-table of the examination:—

<i>December 21st, 1885.</i>			
9 a.m. to 10.25 a.m.	.. .. .	.. .. .	Geography
10.35 a.m. to 12 noon	.. .. .	.. .. .	History
2 p.m. to 4 p.m.	.. .. .	.. .. .	Literature
<i>December 22nd, 1885.</i>			
9 a.m. to 11 a.m.	.. .. .	.. .. .	Arithmetic
11.10 a.m. to 12 noon	.. .. .	Orthography and Orthöpy	
2 p.m. to 4 p.m.	.. .. .	.. .. .	Grammar
<i>December 23rd, 1885.</i>			
9 a.m. to 10.45 a.m.	.. .. .	.. .. .	Composition
11 a.m. to 11.15 a.m.	.. .. .	.. .. .	Writing
11.15 a.m. to 12 noon	.. .. .	.. .. .	Drawing

Reading to be taken on either day or on both days, at such hours as may best suit the convenience of the examiners.

NOVA SCOTIA.

From our own Correspondent.

H. W. Smith, B.Sc. of Cornell University, has been appointed to the recently created position of Lecturer on Agriculture in connection with the Provincial Normal School. The Legislature has provided for a united number of special schools throughout the Province in which particular attention shall be paid to agricultural studies. The new department of the Normal School is designed partly to train teachers for these schools, and partly to afford at least the rudiments of agricultural education to farmers' sons un-

able to attend the regularly organized Agricultural Colleges of other countries. Mr. Smith will also aid the regular faculty in giving instruction in scientific subjects to the general classes of teachers in training. He comes with the highest recommendations of the Cornell Faculty. Moreover he is himself a practical farmer of large experience, engaging in the work of disseminating agricultural knowledge under the impulse of genuine professional enthusiasm.

The annual session of the Teachers' Association for Inspectoral District No. 8 (counties of Inverness and Victoria) was held at Whycocomagh, C.B., on the 10th and 11th of September. Considering that the counties comprising the District have no railroads and but imperfect steamboat facilities, the attendance of teachers—about fifty—may be regarded as good. The general Inspector, J. Y. Gunn, Esq., presided with tact and ability. The regular programme included the following, among other papers:—"Study and Culture," by Mr. McLeod Harvey, of Whycocomagh; "Retarding Influences in our Schools," by Mr. R. W. McCharley, of Victoria County; "English Grammar," by Joseph W. McDougall, of Port Hood; "The Rose and Poetry of a Teacher's Life," by Mr. Geo. Patterson, B.A., Principal of New Glasgow High School, formerly Principal of the County Academy, Boddeck, Victoria County. The papers, which were all interesting and carefully prepared, raised many points for earnest and profitable discussion. Beside the formal papers, several matters of demonstrative principle and detail were brought forward and good-humoredly discussed. The Superintendent of Education, Dr. Allison, was present from the opening of the session to its close, and was formally thanked by the Association for the interest taken in its proceedings. On the evening of the 10th, a public educational meeting was held in the Village Hall, which was crowded to repletion. The chair was taken by Hon. John McKinnon, ex-M. E. C., and addresses were delivered by the Chairman, the Superintendent of Education, Inspector Gunn, L. G. Hart, Esq., and other gentlemen. The counties of Inverness and Victoria comprise one of the most beautiful and fertile districts of the Province, and on the outlook of education within their borders is highly favorable.

The Teachers' Association for Inspectoral District No. 7 (Counties of Cape Breton and Richmond), was held at Sydney on the 17th and 18th of September. The following are the officers for the current year:—M. J. T. McNeil, President, *ex officio*; F. T. McKeen, Vice-Pres.; B. McKittrick, Sec. & Treas.; I. K. McK. Gillis, Neil Fergusson, W. Haggerty, Miss Jetta Gibbons, Miss Maggie Muggah, with the officers, Ex. Com. The first paper on the programme was on "The Teacher's Qualifications," prepared and read by Mr. A. K. McLennan. The subject was ably discussed under the following heads: (1) Natural aptitudes for teaching; (2) Acquired skill; (3) Moral fitness; (4) Scholarship. The essayist's views were discussed, and to some extent criticized, by several speakers, including among others, Messrs. McKittrick, McAdam, Phalen, and the President. The Superintendent of Education, who expressed his gratification at again meeting the teachers of the District, did not attach as much importance as some to what are called "the natural qualifications of the teacher." A teacher can be successful only by studying and understanding the principles of Educational science. These principles are certain and fixed, and no teacher who aims at efficiency can afford to play "fast and loose" with them.

Miss Stephen Martell followed with an excellent paper on "Proper Methods of teaching Geography." The essayist dwelt on the lack of practical aim as characteristic of too much of the current teaching of Geography. Her own practice was interestingly unfolded. The paper was favorably commented on by the Superintendent of Education, Mr. McKittrick and others. An essay on "Home Work," by H. Mellish B.A. elicited a long and profitable discussion. Mr. M. did not attempt to deal with his subject in a dogmatic manner, but rather throw out enquiries as to the proper mode of treating failure on the part of students to prepare their assigned lessons. The answers given by different members of the Association indicated a considerable variety of opinion, and of practice, too. Dr. Allison urged that teachers should aim at keeping the practical difficulty within the narrowest possible limits. Very youthful pupils should not be burdened with home-lessons at all. Much of the "keeping in" and other punishments now imposed were due to the assignment of unreasonable tasks to children already tired, and needing rest or play, rather than fresh work. Two other excellent papers were read before the Association, one on the subject, "Teaching a stopping stone to other professions," by Mr. R. M. Phalen; the other, by Miss M. C. Thompson, on "The Art of Reading." Mr. Phalen strongly emphasized the in-

jury done to the cause of Education by those who engage temporarily in the business of teaching, using it simply as a means of advancement to other professions. His views were combated by several speakers, who urged that whatever evil might thus be done was more than counterbalanced by the freshness and energy thus kept ever present in our schools. Among other items of miscellaneous business, a resolution in favor of readjusting the school year, so as to have one long continuous term, instead of two short terms as at present, was brought forward and discussed at some length. The resolution was finally laid upon the table. The attendance at the Association was large, the papers excellent, and the discussions, though frank and spirited, were marked by the best possible spirit. No doubt the proceedings will give a marked impulse to education in one of the largest and most populous of our Inspectoral Districts.

### Literary Chat-Chat.

"The Russian Stormcloud" is to be the title of a new work by Stepaniak.

The celebrated American historian Bancroft recently celebrated his eighty-fifth birthday at Newport. He is still hale and able to enjoy life even on horseback.

Mr. Hamilton W. Mabie, Associate Editor of the *Christian Union*, is, in accordance with a wish expressed by the late Mrs. Helen Hunt Jacks in shortly before her death, to write a biography of this talented and noble-minded writer.

The forthcoming book containing the private correspondence of Peter the Great, of Russia, will have an immense sale if its contents approach the raised expectations of the public. Of course most Canadian readers—those who understand Russian, will probably not form a long roll of exceptions—will have to wait for the translation, which will be pretty sure to follow quickly.

The fourteenth edition of Miss Cleveland's book "George Eliot's Poetry, and other Studies," is announced by the publishers (Funk & Wagnalls, New York).

*The Voice*—a National Prohibition Party Paper—was started as a regular weekly paper January 1st, of this year. (Funk & Wagnalls, New York.) It has had a surprising success. The weekly issues are now over 60,000. The paper has aroused great interest among temperance men. The price of *The Voice* is one dollar per year.

The author of "The Bunting Ball," whose name has not yet been announced, is preparing for early publication "an opera without music," entitled "The New King Arthur." It promises to be something quite novel in the literary world. The publishers (Funk & Wagnalls, New York) promise the book by November 1st. Below we give the dedication:

TO ALFRED, LORD TENNYSON.

Take, Alfred, this mellifluous verse of mine  
Nor rank too high the honor I bestow,  
Howe'er it thrill thy soul with grateful pride.  
For thou hast sung of Arthur and his knights,  
And thou hast told of deeds that they have done,  
And thou hast told of loves that they have loved,  
And thou hast told of sins that they have sinned,  
And I have sung in my way, thou in thine.  
I think my way superior to thine,  
Yes, Alfred, yes, in loyal faith I do;  
But if I do I may be right or wrong;  
And whether right or wrong, what matters it?  
For shall not swans be swans though geese are geese,  
And if our swans be geese yet swans are deemed,  
The merrier for ourselves that deem them swans.  
So take my verses, Alfred, nor with shame  
Too deeply blush, as when we gain a boon  
So precious that we know 'tis undeserved,  
For thou hast very creditably sung  
Of Arthur, if we judge thee all-in-all;  
And I, if I more creditably sing,  
Can help it not; but let us live our lives.  
For now o'er tilth and wold, o'er waste and weald,  
Full summer broods, the linnets warbles peace,  
The red kine stray and butter has gone down!

*Mind in Nature*, the new monthly journal devoted to psychological discussions, by the Cosmic Publishing Co., Chicago, is improving from month to month. Among the articles this month are, "Mind in Nature," by A. E. Small, M.D., Prest. of Hahnemann College, Chicago, another of Prof. John Fraser's papers, this one "the Supernatural in Literature," a thoughtful article on "Cause or Effect" by "T. G. (presumably an agnostic.) A plea for "Spiritual Force" by Romane C. Cole. "Inspiration" by Emma E. Barlow, "Mental Contagion" and several other interesting papers by other writers.

### Question Drawer.

#### QUESTIONS.

1. In Part II of the new Ontario Readers, Lesson vi., occurs the sentence: "Milk is good to eat in its own form." My class have some doubts about this statement, and I do not admire it myself. Can you throw any light upon the subject?

2. In Part II of the old Ontario Readers, Lesson xii., occurs the statement: "The bear has no tail." In the World of Ico" is an account of a sailor tying two Polar bears (or rather bear skins with men inside) together by the tails. Which is right?

3. Are subscriptions to the Superannuation Fund to be paid yearly or half-yearly? How should they be sent? T. P.  
Lako Opinicon.

Solve—

$$(1) x^2 + y = 7; (2) x + y^2 = 11.$$

STUDENT.

#### ANSWERS.

T. P.—Your first two posers we leave, together with Student's Algebraic problem to be solved by correspondents. In reply to No. 3, the subscriptions, so far as now received, are payable yearly as heretofore, but no new subscriptions are now taken. The money should be sent to the Secretary of the Education Department.

In reply to inquiries from T. P. and others we may say that it is our intention to publish notes on all the Entrance and High School Literature required at the successive Examinations in time to be useful to teachers in preparing classes for these Examinations. We shall complete first the selection from the new Ontario Readers, after which we may supply papers on the selections omitted from last term's series.

### Literary Review.

ELEMENTARY ALGEBRA FOR SCHOOLS, by H. S. Hall, B.A., and S. R. Knight, B.A.; 358 pp. Macmillan's London, Wilhamson & Co., Toronto.

The 3500 well graded examples of this book are admirably suited for beginners, and a large number of them are capable of treatment by short neat methods such as are developed in Dr. McLellan's *TEACHERS' HANDBOOK*. In general the authors have proceeded very carefully from the simple to the complex, from the particular to the general, but they have not held fast to this principle with entire consistency; for example, the simple equation is not introduced till p. 48, whereas it ought to appear among the first and most simple exercises. The examples are well chosen, but the text follows the clumsy traditional methods far too closely in many places, when newer and more powerful examples might have been expected. The principle of Symmetry receives little or no notice, and in Removal of Brackets, H. C. M., and L. C. M., Resolution into Factors, Identities &c., there is nothing new in the text, the old mechanical processes being followed throughout.—But the examples are good and in the hands of a skilful teacher may be made a very effective first course in the science. The general character of the book is similar to that of Hamblin Smith's *Algebra* and his separate collections of examples. While we regret the timidity of the authors so far as the text is concerned, we can cordially recommend their book as a valuable collection of well graded examples, suitable for many of our High and Public Schools.