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# THE SCHOOL MAGAZINE.

JANUARY, 1881.

HEALTH DEPARTMENT.

*Editor: A. Hamilton, M. A., M. D., Port Hope, Ont.*

THE SCHOLAR'S EYE.

## V. ASTIGMATISM.

*Nature of Astigmatism.*

*Its causes.*

*Its frequency; statistics.*

*Its effects.*

*Treatment.*

THROUGHOUT this series of articles on the Scholar's Eye, it is presumed that the reader comprehends that rays of light are brought to a focus on the retina. This focus is theoretically a point for each point of the object. If the eye be perfect in shape and in refractive power, the pencil of light received by the pupil is made to focus at a point on the retina. That this should be so it is necessary that in each and every section made through the centre of the pupil there shall be the same curvature at corresponding parts of the section, and the same density of the refractive media and other transparent structures. But suppose we have in one section one degree of curvature of the cornea, and in another a different curvature; one degree of density at one part of the section and

a different degree at another. Each will bring rays to a focus at a point, but not the same point for each. Refraction is different with different degrees of curvature and density. For a third section through the centre of pupil and corresponding to a third meridian on cornea, we have a third focal point, and so on for each meridional section. This condition is called astigmatism. In other words we have numerous focal points instead of a single one. Some of the focal points may coincide. There will then not be so many focal points as there may be sections. The result is a blurred image on the retina, and consequent defective vision.

Its causes are chiefly *congenital*. We are born so—a minor malformation in so far as its extent is concerned, but often important if occurring in an organ of such delicate structure as the eye. Other causes are *acquired* during life. Such are chiefly the effects of ulcers and injuries to the cornea and the changes caused by inflammation. These are often manifest on inspecting the cornea. Slight malformations are common all over the body. Fully eleven noses out of a dozen are deflect-

ed to one or the other side. Slight injuries occur everywhere, but are much more noticeable in the structures of the eye, if judged by their effects.

Low degrees of astigmatism are very common. They seldom diminish vision to any great extent. Higher degrees are less common, but more serious as to damaging vision. Of 630 pupils examined for it by Drs. Williams and Ayers in the District, Intermediate, Normal and High Schools of Cincinnati, 25 astigmatics were found—four per cent. Among the same pupils there were 72 shortsighted. We may therefore infer astigmatism to be one-third as frequent as Myopia and to be about four per cent. It is usually combined with either shortsightedness or oversightedness. Sometimes shortsighted astigmatism is found in one meridian and oversighted astigmatism in another.

Its effects are to diminish the acuteness of vision for both distance and for near objects. Should the scholar persist in using the eye largely, in spite of its defect, the consequence will be a complaining eye or eyes and inability to pursue fine work. Such complaints are similar to those produced by shortsightedness and oversightedness.

The treatment of such cases is by the use of glasses, but it is not resorted to except in the higher degrees and more urgent cases. It takes several hours of very careful examination before a case can be prescribed for. The glasses have to be ground for each case and hence are very expensive. For these two reasons, both included under cost, it is plain that a majority of cases go untreated. A case without glasses should not be urged to commit long lessons, or be expected to excel in his classes.

## THE WASTE OF LIFE.

An address with the above title has been given not long ago by Dr. A. N. Bell, of Brooklyn, N. Y., editor of the *Sanitarian*.\* By the title is meant the excessive and preventible loss of life from bad hygiene. "It is held in law that whoever accelerates death causes it," says Taylor.† Among the several causes there enumerated the school-house comes in for the following notice:—

"School-houses, public and private, are a disgrace to human nature. Situated, constructed and furnished with utter disregard of the nature of the soil, exposure, air and light, they are in effect systematic institutions appropriated to the nurture of disease and the acceleration of death. With reading lessons recounting the horrible act of the half civilized nabob of Calcutta, more than a century ago, and the no less barbarous act of the captain of the emigrant ship *Londonderry*, twenty-five years ago, and school physiologies teaching that each individual requires for healthy respiration 2,000 cubic feet of air hourly, notwithstanding these instances and this patent knowledge, examples are not wanting in the public schools of our large cities where the air-space appropriated is less than fifty cubic feet and with little or no provision for change: literally, schools for the growth, culture and promotion of scrofula and consumption, and the hurdling places of the infections of childhood. Three hundred cubic feet of air-space, with efficient provision for change three times an hour, is the lowest possible estimate which should be allowed. With less than this, the air speedily becomes poisonous and the active nidus of infection."

\*Trans. American Medical Association, 1874.

†Medical Jurisprudence, Amer. Edit., 1861 p. 470.

## SCHOOL DISCIPLINE.

Address delivered before the East Middlesex Teachers' Institute, Oct. 23rd, 1880.—

By J. H. DONALDSON.

(Condensed for School Magazine.)

**M**R. President and fellow teachers : In calling your attention to School Discipline I have purposely omitted reading a paper on the subject, but have preferred addressing you in a conversational style, for I have noticed, in my connection with teachers' institutes, that when a paper entering into the details of the subject has been presented, the discussion generally ceases with the reading of the essay ; whereas, a less formal introduction, has a tendency to draw out the opinions of the teachers, and the result is an amount of practical knowledge not otherwise obtained. This subject is one that is well adapted for a general discussion, it is one in which every teacher is interested, it is one which enters into the duties of every school day, and if my remarks are not followed by a general discussion, then the object I have in view will not have been fully accomplished. I have, to a certain extent, systematized my remarks in order to assist your memories and enlist your attention.

School Discipline embraces not only the maintenance of order, the subordination of the pupils to authority, their prompt obedience, their quiet and uniform movements, their application to study, and other features of mechanical school drill, but it includes a suitable arrangement of classes and rotation of studies, so as to secure a change of posture for the pupils, and a variety of exercises for their minds, thus resting, without loss of time, their physical and mental natures ; it embraces the methods of

teaching, a systematic rotation of examinations, the cleanliness, ventilation and adornment of the school-room, and a scheme of appropriate rewards and penalties.

The subject in its extended sense is so comprehensive, that time forbids taking it up in its widest meaning ; I will, therefore, confine my remarks to it in its restricted sense—the maintenance of order, the prompt obedience and uniform movements of the pupils.

I. I will first refer to the importance of discipline under the alliterative heads, *Essential*, *Elevating*, and *Enduring*.

(a) It is *Essential* or necessary. I cannot conceive how a teacher can successfully impart instruction, manifest a pleasant disposition, or win the esteem of the pupils, unless discipline is strictly, though kindly, enforced. I cannot conceive how pupils can diligently and satisfactorily apply themselves to study, unless an air of quietness and studiousness pervade the school-room. The buoyant, enthusiastic natures of the children, their natural disinclination to concentrate their energies on their studies, will certainly lead to inattention, and very much retard their progress, unless the reins of authority be held with a firm though gentle grasp.

It is *Essential* as a time-saver. We all know as individuals that we can do more work and do it better by having some systematic method of procedure ; now, if this principle has force with respect to individuals, it has much greater force with respect to

groups of individuals. For instance, a teacher tells a boy that at ten o'clock he will call him to the front. At the appointed time the teacher says "John Jones, rise, forward;" you will readily admit that, without any special effort, the boy can quite quickly and quietly obey. Now, instead of this individual let us substitute a class; thus, "Fourth class, rise, forward:" if each individual respond as readily as John Jones the whole class will be at its place as quickly as if it were composed of one pupil. Each pupil knows from the time table the exact time when his class will be called as accurately as if he had been told to be ready at ten o'clock.

(b) It is *Elevating*. Pupils take pride in doing things well. Simultaneous movements in a class or in the whole school have a particular charm for them. Care should be taken to have the movements of a graceful nature and they should be taught to consider themselves ladies and gentlemen in miniature. Teach them to regard the school-room as a place of refinement, free from rudeness or boisterousness like their parlors at home. A quiet and respectful demeanor in the school-room, during noon and recess; the control of their voice in conversation, not raising it higher than they would at home at the meal or by the fireside, have a tendency to create a self-respect that is certainly elevating. The boy who is trained to go through a simple drill before advancing to his class, or retiring to his seat, to place his slate, book, or hands in a certain position, to refrain from turning round on the entrance of a visitor or a late pupil, to respectfully salute those whom he may meet on the way, to civilly ask a ride before getting on a passing waggon, will have implanted within him a courtesy and a refinement of character, which will prevent him from boisterously, rudely, or awkwardly entering

a public meeting, his own home or his neighbor's house; he will enter society with greater ease, will not have his attention attracted to the door during the delivery of a sermon or an address. The pupil who is required to refrain from whispering during study hours will very likely listen in silence to discussions at a public meeting, in short, will acquire a culture and a refinement which book-knowledge alone will not impart. Did not the introduction of military drill into the Collegiate Institute of this city, the formation of a company, the prompt obedience required, the uniformity of dress and movements, inspire the pupils with a worthy ambition, a desire to excel, a manly self-respect, of a dignified and elevating nature?

(c) It is *Enduring* in its effects. The minds of children are easily impressed. Not only are impressions more easily made but they are longer retained. The scenes and associations of the school-room have a powerful influence on pupils' minds in after life. The orderly movements, the habits of punctuality, promptness and accuracy acquired, would influence to a very great extent their after career. Children are imitative beings and they intuitively receive impressions which are never obliterated. The school is a kingdom in miniature, and the training to which pupils are subjected, if it be proper training, will make them better citizens, will teach them to submit willingly to the civil authority, will enable them to exercise self-control, and overcome difficulties, when they arrive at maturity, much more easily. Some persons whose means are ample prefer to have their children educated privately. Now the additional progress which they may make is not equivalent in point of usefulness to the training they would receive in a well-organized school. The pupil who has received proper discipline in his school days, who has profited by meeting in class-

room and play-ground with his school-mates, is more self-reliant, practical, and a more useful member of society, than his more learned but less disciplined neighbor.

II. I will now take up the duties of teachers to be fulfilled in order to be successful as Disciplinarians.

(a) A teacher should be *punctual*. I have placed this characteristic first, as I consider it one of the principal qualities required to ensure success. His hand should pull the bell-rope at the very instant the clock indicates the time; classes should be called and dismissed, recesses granted and studies resumed precisely at the time marked on the time-table; lessons should be assigned that will exactly extend over the allotted time. The continuance of a class after the usual time for dismissal interferes with the punctuality of the next class, and, to a certain extent, disarranges the whole school.

(b) A teacher should be *pleasant*. A pleasant teacher makes a pleasant school. Pupils imitate the actions, tones of voice, and even the disposition of the teacher unconsciously. It will require some effort on the part of the teacher to appear pleasant when matters are not gliding along smoothly, but the exertion in this way is amply repaid by its reflection in the demeanor of the pupils.

(c) Again, a teacher should be *persevering*. He should adopt for his motto, "Try, try again." If he fails to realize his highest expectation he must profit by his failure and "try again." If he succeeds in a degree highly satisfactory, he must seek to maintain that degree of excellence he may not expect to surpass. Take away perseverance from the teacher's qualifications, and the prospects of success of an otherwise excellent teacher are very materially lessened.

(d) A teacher should be *polite* in his intercourse with his pupils, and he will win their esteem and exert an influence

not otherwise attained.

(e) That he should be *patient* is so manifest that "I need not dwell," for "he that ruleth his own spirit is greater than he that taketh a city."

III. I now call your attention to the duties of a teacher in his position as a judge. He is required to perform the duties of both judge and jury.

(a) In his judgments he should be *deliberate*. The case should be thoroughly investigated, the evidence carefully weighed, no undue haste manifested, but a cautious, thoughtful desire to arrive at a just and considerate verdict.

(b) He should be *Definite*. No doubt should exist in the minds of the pupils as to his intentions; he should allow no uncertain ambiguous meaning to be taken from his words.

(c) He should be *Decisive*. When he announces his verdict in a clear definite way, after due deliberation, it should be done without hesitation, and final as far as he is concerned. Decision of character is an important element in the constitution of a teacher and should be cultivated and exercised under all circumstances. A teacher of an irresolute temperament cannot maintain his dignity and in no case is decision of character more necessary than in the administration of justice.

IV. I will now speak of the movements of the teacher.

(a) He should move *Quietly*. "Example is before precept." The imitative propensities of the pupils will be exercised in a marked degree in this respect. The quiet movements of the teacher, free from bustle and confusion, will have a subduing influence on the pupils that a dozen lectures per week on good order could not effect. As the teacher is, so shall the pupils be. The teacher's voice should be only sufficiently loud to be distinctly understood; his foot-fall should never resound through the school-room; the bell on his desk

should never be boisterously rung, but gently chimed; he should be a living example of what he demands of his pupils. I have known teachers to wear slippers in the school-room in order to move quietly; I disapprove of this. The pupils perceive that they are placed at a disadvantage and become discouraged in their efforts to move as quietly as the teacher, but if the teacher shows what can be done they are encouraged to further efforts and generally succeed. So great is the influence of example in this respect that a pretty accurate idea of a teacher's deportment in the school-room may be obtained by spending an hour in his school during his absence. Some persons mistake noise and bustle for energy; a greater mistake was never made. I think correct observation will bear me out in this statement, that the most energetic teachers are not those who are able to concentrate the greatest number of units of work into a given time.

(b) He should move *Quickly*. Quiet movements do not imply slow movements. His mode of speaking and his every action should be lively, and animation will be imparted to the pupil. A wide-awake, brisk demeanor on the part of the teacher will rouse the pupils from indolence to that state of mental activity best adapted for the reception of knowledge.

V. I will next refer to the "Duties of Pupils." My remarks on the duties of teachers, can, to a great extent, be applied to pupils also, for pupils should be punctual, pleasant, persevering, polite, quiet and quick. I will treat of the duties of pupils under the comprehensive head of obedience.

(a) It should be *Ready* or prompt. The pupil must be impressed with the idea that the teacher's will is law. - It is wise on the part of the teacher to explain the reason of the rule and secure their willing obedience, but he must insist on being promptly obeyed. If he makes a request the pupil should

not delay to complete the writing of a word, or resolve in his mind why the request is made but promptly respond.

(b) The obedience of the pupils should be *Respectful*. Pupils who obey according to the letter but not the spirit of the rules, are not desirable subjects in the school kingdom. If circumstances require it the teacher must not hesitate to enforce his commands, but the duty of the pupils is to render a cheerful, respectful obedience simply because it is for their own welfare and not because it is compulsory.

(c) The obedience should be *Regular* or uniform. All the pupils in a class or school should make the same movement at the same time. Let the pupils be taught when and how to obey and then see that the obedience is simultaneous. If the request be made to discontinue study, that very instant every pupil should be motionless; at the chime of the bell the movement required should be instantly executed by every pupil of whom it is required. As a time-saver, as an incentive to order, as a means of securing submission to authority, uniformity of action stands very high,

VI. Your attention is now called to the means by which discipline may be maintained, to certain methods of procedure pertaining to the arrangement of classes and the management of pupils. It is customary in some well regulated schools to form the pupils into ranks outside the school-room, and admit them in regular order. Under certain circumstances this plan is excellent; but if the weather be unfavorable it could not be carried out with any degree of regularity. Again, if the pupils be summoned from the playground by ringing a bell they will continue their game until the last moment and then an indiscriminate rush is made for their seats. Now I assume that every well-disciplined school has a clock. Let the pupils understand that at 9 o'clock precisely they must

be in their places quietly awaiting the opening exercises within a few minutes of the time they quit their games and leisurely put hats in places, get books arranged, and silence reigns as the teacher steps forward to open the school. A double purpose is thus effected: the pupils are invested with a certain amount of responsibility, they must take a note of time and arrange their games accordingly; no rude rush is made to reach their seats in the least possible number of seconds. Now, are not the pupils in a fitter state for the opening exercises, in a better mood to resume study and control their actions, than if they rushed pell-mell, panting and heated from their play? Is not a kindlier feeling established between teacher and pupils by a minute's silence as they sit with folded arms awaiting the announcement that school is opened? At the expiration of each recess, and at 1 o'clock let the same punctuality and quietness prevail and the continuance of good order is very much assisted again; under no circumstances permit play or boisterous conversation in the school-room. Impress the pupils with a feeling of respect for the school-room, require the boys to remove their hats if their stay in the room be only for a moment; see that the floor is kept clean and the general appearance of the room tidy. The boy who takes off his hat and controls his voice as he enters the school can not act so rudely as if these simple rules were not observed.

Let whispering during school hours be strictly prohibited. Talking is fatal to good order. If the pupils were few in number and could be depended upon to speak only of their lessons the rule might be abolished, but I have not yet noticed a case in which it could be advisedly done.

Next, arrange the classes in lines, the pupils in each class sitting not side by side, but in rows, extending from the further end of the room to the front.

This arrangement is made irrespective of sex, boys and girls sitting side by side if the classification requires it. If it is right for boys and girls to associate with each other at noons and recesses, on the way to and from school when the teacher's eye is not on them, if it is right to stand together in classes, it is proper to sit together at their seats during study hours. By this plan when a class is called there is not an uprising in different parts of the room; the members of the class rise with regularity, and in rotation advance to the front; or, still better can be considered a class while at their seats, each pupil rising as he or she is called upon to recite.

The hooks for clothing generally extend the whole length of the room on both sides. To prevent confusion each pupil is required to place his or her hat and clothing on the hook opposite or nearly opposite to his or her seat. In the evening the outside rows of pupils rise and in a few moments pass the clothing to those sitting parallel with them towards the interior of the school.

Let there be no passing out during school hours unless under exceptional circumstances. The recesses are intended to supply the place of promiscuous passing out and should be used for that purpose.

Instead of changing places in the class let a system of marks be adopted, and the disputes with regard to their places will be avoided; the pupils can also advance to their classes and retire to their seats with regularity.

With regard to rewards and penalties I would mention as examples:

If pupils refrain from whispering in school for a month enrol their names under the head of "The Illustrious" and post them up in the school-room.

The ambition to have their names inscribed on that list is much more general than might be at first imagined. It is not an over-estimation to say that in a school averaging 60 pupils not



more than half a dozen will violate the whispering rule, and by proper management the majority of pupils will refrain from whispering during school hours for a whole year. This grade of good conduct is not reached by a harsh enforcement of rules, but by the resolution of the pupils themselves, everything running smoothly along, the teacher, of course, directing affairs with tact and watchfulness.

If necessary, a pupil can get permission to speak, and three minutes for whispering at 10 a. m. and 2 p. m. may be granted as an appropriate reward.

If a boy fail to be promptly at his seat cancel a portion of his recess. If he enter the school with his hat on, call the attention of the pupils, after school is opened, to the fact that a boy so far forgot his manners as to enter the room with his hat on.

If a pupil walk rudely to his class, require him to do it over again till it is well done.

If the door creak on its hinges, apply a little oil.

If the desks become loose, have them fastened.

If the stove require fuel, see that it is noiselessly supplied, &c., &c.

Success in keeping good order is not the result of harshness but the reverse. A misdemeanor mark should rarely be given; days should pass by in which neither reproofs nor penalties require to be inflicted; corporal punishments should very rarely occur; but let it be borne in mind that if the rules be violated the punishment will surely follow.

What a nice state of things when pupils work in unison with the teacher, honestly striving to observe the spirit of the motto, "Do Right." "Behold how good and how pleasant it is for brethren to dwell together in unity."

## ENGLISH GRAMMAR AND ETYMOLOGY.

FIRST CLASS TEACHERS—GRADE C.

July, 1880.

Ham.—

How all occasions do inform against me,  
And spur my dull revenge! What is man  
If his chief good, and market of his time,  
Be but to *sleep*, and feed? a beast, *no more*.  
Sure, He that made us with such large dis-  
course,

Looking before and after, gave us not  
That capability and godlike reason,  
To fust in us *unused*. Now, whether it be  
Bestial oblivion, or some craven scruple  
Of thinking too precisely on the event, 10  
A thought, which, *quartered*, hath but one  
part wisdom,  
And ever three parts *coward*, I do not know

Why yet I live to say, " 'This thing's to do ;'  
*Sith* I have cause, and will and strength, and  
means,

To do 't. Examples, gross as earth, exhort  
me : 15

*Witness* this army, of such mass and charge,  
Led by a delicate and tender prince ;

Whose spirit, with divine ambition puffed,  
Makes mouths at the invisible event ;  
Exposing what is mortal, and unsure, 20

To all that fortune, death, and danger, dare,  
Even for an egg-shell. Rightly to be great  
Is not to stir without great argument,  
But greatly to find quarrel in a straw,  
When honour's at the stake. How stand I,  
then, 25

That have a father *killed*, a mother stained,  
*Excitements* of my reason and my blood,  
 And let all sleep? while, to my shame, I see  
 The imminent death of twenty thousand men,  
 That, for a fantasy and trick of fame, 30  
 Go to their graves *like* bed; fight for a plot  
*Whereon* the numbers cannot try the cause;  
 Which is not tomb enough, and continent,  
 To hide the slain? O, from this time forth  
 My thoughts *be* bloody, or be nothing worth!

35

—SHAKESPEARE; *Hamlet*, Act iv. Sc. 4

## 1. Parse the sixteen words in italics:

*How* is a simple adverb of manner, without comparison, modifying *do inform*.

*To sleep* is a verb of the irregular weak conjugation, intransitive, and in the present tense of the Infinitive mood; used as an adjective in the predicative relation to the nouns *good* and *market*.

*No* is a simple adverb of negation, modifying the adjective *more*.

*More* is a quantitative adjective, in the comparative degree, and in the predicative relation to the pronoun *he* understood; the ellipsis being supplied thus;—He is no more than a beast.

*Unused* is a qualitative adjective, in the positive degree, and in the predicative relation to the pronoun *us*.

*It* is a neuter demonstrative pronoun, of the third person, in the singular number, and in the nominative case, forming the subject of *be*.

*Quartered* is the perfect participle of the verb to quarter, qualifying the pronoun *which* to which it is joined attributively.

*Coward*, a noun, common, masculine gender, of the third person and singular number, and of the objective case, in apposition with the noun *parts*.

*Sith* is a causal subordinative conjunction, connecting "this thing's to do" with the following sentence.

*Witness* is a verb, transitive, in the active voice, of the weak conjugation and in the Imperative mood, second

person plural, to agree with its subject *you* understood.

*Killed* is the perfect participle of the verb "to kill," qualifying the noun *father*, to which it joined attributively.

*Excitements*, a noun, abstract, in the neuter gender, plural number, third person and objective case, being in apposition with "father killed, a mother stained."

*Let* is a verb, transitive, in the active voice, of the irregular weak conjugation, and in the Indicative mood, present tense, third person, singular number, agreeing with its subject *that* understood.

*Like* is a simple adverb of manner, modifying the verb *go*.

*Whereon* is a conjunctive adverb, modifying the verb "can try," and connecting the sentence "fight for a plot" with the one following.

*Be* is a verb, intransitive, irregular strong conjugation, in the Subjunctive mood, present tense, third person, plural number, agreeing with its subject *thoughts*.

2. Write short explanatory notes on *market*, (l. 3,) *argument*, (l. 23,) and *continent*, (l. 34.)

*Market*, "That for which he sells his time"—*Johnson*. "The business in which he employs his time."

*Argument*, subject, matter in dispute.

*Continent* is used here in its primitive sense—that which holds or contains.

3. What examples, in the passage, of the gerundial infinitive?

The term gerundial infinitive, is by some grammarians applied to the infinitive, denoting purpose; in the latter sense we find the infinitives *to fust*, *to do* (to do't), and *to hide*.

4. Paraphrase l. 19, ll. 29-33, bringing out the meaning fully.

(a) "Scoff at the unforeseen result."

(b) "While, to my confusion, I foresee the impending death of twenty thousand men, who for the delusive artifice that promises future fame, proceed as

calmly to their graves as to their beds ; contend for a spot of earth on which there is not room enough for the number of warriors to bring the cause of dispute to a decisive termination ; and which is not even large enough to afford burial room for the dead."

5. Derive *revenge*, (l. 2,) *craven*, *scruple*, (l. 9,) *fantasy*, (l. 30,) *continent*, (l. 33,) *coward*, (l. 12.)

*Revenge* is from the Latin *re*, again, and *vindico*, I claim.

*Craven*, originally *cravant*, the cry of one beaten in single combat ; from old French *cravante*, to overthrow.

*Scruple* is derived from the Latin *scrupulus*, the diminutive of *scrupus*, a rough, sharp stone.

*Fantasy* comes from the Greek verb *phantazo*, I make visible.

*Continent* is from the Latin *con*, together, and *teneo*, I hold.

*Coward*, literally *one who turns tail*, from the Latin *cauda*, a tail, and the common Gothic affix *ard*.

6. (l. 23,) "To stir ;" is this subject or predicate ? Give reason.

In order to ascertain what is properly the subject of the sentence here, we would require to refer to the context and notice what is the subject of the speaker's thought. We find that he is bewailing his lack of decision, or in other words, of greatness. We would therefore infer that "to be rightly great" is the subject of his thought, and consequently, of the sentence.

7. Point out, name, and show the force of the figures of speech found in the extract.

We may notice first the use made of exclamatory and interrogative sentences for rhetorical purposes. Exclamations and questions are useful in breaking monotony, and in themselves have greater force and vivacity than the ordinary declarative structure. A passionate exclamation, as in the concluding sentence of the extract, is termed *epiphonesis*.

The figures of similarity, *metaphor* and *simile* are especially noticeable. They afford the mind an agreeable surprise from presenting to it some resemblance between two objects that are dissimilar ; a resemblance which the mind had never previously, perhaps, observed. They are sometimes used to aid the understanding or to deepen the impression on the feeling. The metaphor, from its condensed structure, has more of sententious effect than the simile, and has the additional advantage of not disturbing the structure of the composition.

Examples of *metaphor* : 'spur,' 'market,' 'to fust,' 'quartered at the stake,' 'tomb,'

Examples of *simile* : 'as earth,' 'like beds.'

There is noticeable also the figure of *personal metaphor*, which consists in attributing the actions or qualities of persons to things. Its poetic effect arises partly from the interest attached to the metaphor and partly from the increased interest we take in things or qualities that are represented as being like ourselves.

Examples of *personal metaphor* : 'do inform,' 'dare,' 'makes mouths at,' 'sleep,' (all sleep) 'exhort.'

8. Divide the first fifteen lines into propositions ; state their kind and relation ; and analyse such of them as are dependent.

"How all occasions do inform against me" is a principal exclamatory proposition ; and of precisely the same kind is the next one, "spur my dull revenge."

"What is man" is a principal interrogative proposition.

"If his chief good and market of his time be but to sleep and feed" is a subordinate proposition, adverbial of condition, modifying the verb *is*.

"(He is) a beast ;" "(He is) no more" are principal declarative propositions.

"Sure He, looking before and after, gave us not that capability and godlike

reason to fust in us unused" is a principal declarative proposition.

"That made us with such large discourse," a subordinate proposition, adjectival to *He*.

"Now, I do not know, &c.," a principal declarative proposition.

"Whether it be bestial oblivion" a subordinate substantive proposition, co-ordinate with "why yet I live to say."

"(It be) some craven scruple of thinking too precisely on the event, a thought" is the same as the preceding one.

"Which, quartered, hath but one part wisdom," a subordinate proposition, adjectival to *thought*.

"(Which hath) ever three parts coward," same as the preceding.

"This thing's to do," a subordinate substantive proposition, depending on *say*.

"Sith I have cause and will and means to do't," a subordinate proposition, adverbial of 'reason,' modifying the verb *is*.

Analysis of dependent sentences :

"If his chief good and market of his time be but to sleep and feed."

Subject—'good' and 'market.'

Attributive adjuncts of S.—'his chief' (good), 'of his time' (market.)

Predicate verb or verb of incomplete predication,—'be.'

Complements of the verb—to 'sleep' and 'feed.'

Adverbial adjunct of the C.—'but.'

"That made us with such large discourse."

Subject—'that.'

Simple predicate—'made'

Object—'us.'

Attributive adjunct O.—with such large discourse.'

"Whether it be bestial oblivion."

Subject—"it.'

Verb of I. P.—'be.'

Complement of verb—"oblivion.'

Attributive adjunct of C.—'bestial.'

"(It be) some craven scruple of thinking too precisely on the event, a thought."

Subject—"it understood.'

Verb of I. P.—'be understood.'

Complement of V.—'scruple.'

Attributive adjunct of C.—'some craven, of thinking' . . . 'thought.'

"Which quartered hath but one part wisdom."

Subject—"which.'

Attributive adjunct of S.—'quartered.'

Simple Predicate—"hath.'

Object—"part.'

Attributive adjunct of O.—'but one wisdom.'

"(Which hath) ever three parts coward."

Subject—"which' (understood.)

Simple predicate—"hath' (understood.)

Object—"parts.'

Attributive adjuncts of O.—'three,' 'coward.'

Adverbial adjunct of predicate verb—"ever.'

"This thing is to do."

Subject—"thing.'

Attributive adjunct—"this.'

Verb of I. P.—'is.'

Complement of verb—"to do.'

"Sith I have cause and will and strength and means to do't."

Subject—"I.'

Simple predicate—"have.'

Objects—"cause,' 'will,' 'strength,' 'means.'

Adverbial adjunct of P. verb—"to do't.'

(To be Continued.)

## NOTES ON LAZARE HOCHÉ.

P. 1, l. 8, Le 24 juin, see De F., P 34.

1.—9. The fem. forms *année, journée, matinée, soirée*, express periods of time referring to duration. The masc. *an, jour, matin, soir*, express each a division of time as a unit. These are therefore used in counting and in adverbial expressions—*trois ans, tous les matins*, etc. The fems. are used when duration is implied, *toute la journée, cette année, une soirée* an evening party. Hence these forms have sometimes a secondary meaning, viz: *journée*, a day's work, a battle; *matinée, soirée*, entertainments.

10. *Après*; words ending in *es*, not mute, take the grave accent.

15. *Entre, parmi*; *entre*, between two, among several taken individually; *parmi*, among several taken collectively.

15. *Enfants*; see De F. p. 17, note.

16. *Vivanté*; nouns in *é* are masc., except those in *té* and *tié*.

2—3. *Avait quinze ans*; was 15 yrs. old, also, *était âgé de quinze ans*. *Legumes, exercices, âge*, are mas., *leçon* is fem.

13. *Jeune*, young; *jeûne*, mas. fasting. *Il suffit d'un mois*; a month sufficed for H to pass from.

15. *Manœuvre*; f. manœuvre drill, mas. workman.

20. When the relative *que* is the object, the subject of the verb frequently fols. it.

25. *L'on*; *l'* used for euphony when *on* would otherwise fol. a vowel sound. DeF. p. 51.

35. *Pour se produire*; to make themselves known.

2—11. *Les Grandes-Indes* or *les Indes Orientales*; East Indies. *Les Indes Occidentales*; West Indies. *Service, privilège, obstacle, mérite, génie, ordre*, are masc.

15. *Progrès*, is sing. or plural. A high degree is generally expressed by the plural, as *faire des progrès, bien des progrès*.

3.—25. *Actes*; *action* is the general name for what is done; *acte* is applied only to what is extraordinary, as the acts of great men, princes, etc.

26. *Cités alors*; cited then at every turn in the writings of the day, and in many of the current polemical works. Tinctured with the excitement of the moment; fell into his hands. De F., p. 250, i.

37. Violent and passionate, his pride at least took root most frequently in honest and generous sentiments, which later, when better regulated, became virtues; and it was above all in believing that he was defending the interest of justice and humanity that he suffered himself to be drawn beyond the bounds of moderation.

*Pecule, acte, dente*, are masc. Nouns in *sme* and *ége* are masc. and *u* in *ure* are fem., except *murmure parjure*, perjury.

4.—2. *Délation*; information, acting the part of informer or accuser. *Horreur*; words in *eur* are fem., except names of agents in *eur* and a few others, as *honneur, bonheur, labeur, coeur, choeur, pleurs*, etc.

17. *Demi-mort*; *demi* before the

- noun is invariable and connected with it by a hyphen; after a noun it agrees in gender but remains always sing.; we say, however, *la pendule sonne les demiès*, strikes the half-hours.
32. *Quel beau général*, etc., see DeF. P.
33. *Allaient faire*; events were about to make.
37. *Entre*; among, because *signes* is taken individually.
39. *Meurs*; fem. pl. without sing. Pronounce the *rs*.
- 5.—26. On the other hand a multitude of celebrated writings that were being eagerly read, had caused the new principles of political and social regeneration to penetrate far into the heart of the masses.
34. From (by dint of) hearing every day (some one) declaim against the laws in force.
- 6.—3. *Fussent*; subjunctive, because of the doubt implied in the impersonal, *il était impossible*.
- 6.—8. *Nombre* is number indicating quantity; *numéro* is number indicative of the order E. G. *le numéro d'une page, le n. d'une maison*.
8. *Ces prévisions*; these anticipations were much exceeded by the reality.
34. *Appelés*; verbs in *er* preceded by *é* or *e*, and a single consonant, change *é* or *e* to *è* before a mute syllable (*e, es, ent* and *er* of the future), e. g. *céder, je cède; mener, je mènerai*. But verbs in *éger* always retain the *é*, as *je protège*; and verbs in *eler, eter*, double the cons. before a mute syl., except the fol. which take *è* without doubling the cons., *geler; dégeler; harceler; peler; déceler*, to disclose; *bourreler*, to torment; *étiqueter; acheter; colleter*, to collar.
39. The great questions which were agitating the people, left their (the realm of) pacific debates (in order) to be given over to arbitrary action, to blind and brute force; from this arose great excesses.
- Notice *exemple, reste, trône*, are masc. *Trône*; the circumflux is used to distinguish words spelled alike, or to indicate contraction, as the suppression of a vowel or *s*, or the dropping of an entire syllable. E g. *sur, sûr; paiement* for *paiement*; *blâmer* for *blasmer*; *trône* L. *thronus*.
- 7.—6. *Faubourg*; *g* is pron. *k* in the simple word *bourg*, market-town; but is silent in all compounds.
- C'était là*; these were confined for centuries back upon a simple royal order or arbitrary warrant; the most of those, etc. *Cachet*; seal (of private individuals); *sceau*; seal of sovereigns, states or constituted authorities.
21. After *pouvoir, oser, cesser, savoir, bouger, avoir garde* and *si*, the second part (*pas* or *point*) of the negative may be omitted. After *si, if*, the pres. and imperf. indic. and the pluper. subj. are used, but not the future or cond.
30. After *empêcher* use the subj. with *ne*.
34. *Répartis*; see DeF. p. 130.
- 9.—1. *Nous l'avons vu*; *l'* not translated, refers to the idea fol.
13. *Émence*; fem. riot.
14. *Consigne*; orders, instructions; *signe* is masc., but *consigne* is fem.
17. He was conscious of the power to rise by his services; to attain every rank by legitimate means. He would have blushed to rise by revolt or by treason.

MATHEMATICS.

HORNER'S SYNTHETIC DIVISION.

(From the Quarterly for July, 1878.)

The following explanation of Horner's Division exhibits an easy mode of transition from the ordinary to the synthetic method.

Let it be required to divide  $x^4 + x^3 - 5x^2 + 15x - 8$  by  $x^2 - 2x + 3$

Performing this division in the usual way we get .

$$\begin{array}{r}
 (x^2 + 3x - 2) \\
 x^2 - 2x + 3 \overline{) x^4 + x^3 - 5x^2 + 15x - 8} \\
 \underline{x^4 - 2x^3 + 3x^2} \phantom{- 8} \\
 3x^3 - 8x^2 \phantom{+ 15x - 8} \\
 \underline{3x^3 - 6x^2 + 9x} \phantom{- 8} \\
 -2x^2 + 6x \phantom{- 8} \\
 \underline{-2x^2 + 4x - 6} \phantom{- 8} \\
 2x - 2
 \end{array}$$

The first term in each subtrahend, being always the same as the first term in each minuend, may therefore be omitted, thus:

$$\begin{array}{r}
 (x^2 + 3x - 2) \\
 x^2 - 2x + 3 \overline{) x^4 + x^3 - 5x^2 + 15x - 8} \\
 \underline{-2x^3 + 3x^2} \phantom{- 8} \\
 3x^3 - 8x^2 \phantom{+ 15x - 8} \\
 \underline{-6x^2 + 9x} \phantom{- 8} \\
 -2x^2 + 6x \phantom{- 8} \\
 \underline{4x - 6} \phantom{- 8} \\
 2x - 2
 \end{array}$$

Now, if we bear in mind that subtraction in Algebra is effected by changing the signs of the terms in the subtrahend, and then adding together the subtrahend and minuend, it will readily be seen that if the signs of those terms in the divisor, which produce the subtrahend, be changed, the subtrahend will then be formed ready for adding, and no change of sign will be required. The sign of the first term in the divisor is not to be changed, as it helps to form no part of any of the subtrahends now used. The process

of division will then be as follows:—

$$\begin{array}{r}
 (x^2 + 3x - 2) \\
 x^2 + 2x - 3 \overline{) x^4 + x^3 - 5x^2 + 15x - 8} \\
 \underline{2x^3 - 3x^2} \phantom{+ 15x - 8} \\
 3x^3 - 8x^2 \phantom{+ 15x - 8} \\
 \underline{6x^2 - 9x} \phantom{- 8} \\
 -2x^2 + 6x \phantom{- 8} \\
 \underline{-4x + 6} \phantom{- 8} \\
 2x - 2
 \end{array}$$

Here two terms ( $-8x^2, 6x$ ) occur, which may be advantageously omitted. The first of these is the sum of  $-5x^2$  and  $-3x^2$ ; to this sum is added  $6x^2$  and thus the term  $-2x^2$  is obtained as the sum of  $-5x^2, -3x^2$  and  $6x^2$ . The term  $-8x^2$  is therefore quite unnecessary, and so also is the term  $6x$ . Omitting these quantities, the operation of dividing would then be this:—

$$\begin{array}{r}
 (x^2 + 3x - 2) \\
 x^2 + 2x - 3 \overline{) x^4 + x^3 - 5x^2 + 15x - 8} \\
 \underline{2x^3 - 3x^2} \phantom{+ 15x - 8} \\
 3x^3 \phantom{- 8x^2} \phantom{+ 15x - 8} \\
 \underline{6x^2 - 9x} \phantom{- 8} \\
 -2x^2 \phantom{+ 15x - 8} \\
 \underline{-4x + 6} \phantom{- 8} \\
 2x - 2
 \end{array}$$

This may be more compactly arranged, thus:—

$$\begin{array}{r}
 (x^2 + 3x - 2) \\
 x^2 + 2x - 3 \overline{) x^4 + x^3 - 5x^2 + 15x - 8} \\
 \underline{2x^3 - 3x^2 - 9x} \phantom{- 8} \\
 3x^3 \phantom{- 8x^2} \phantom{+ 15x - 8} \\
 \underline{-2x^2 - 4x + 6} \phantom{- 8} \\
 2x - 2
 \end{array}$$

Now, since in adding any number of terms together the order in which they are taken is immaterial, the third and fourth columns may be rearranged thus:—

$$\begin{array}{r|l}
 x^2 & x^4 + x^3 - 5x^2 + 15x - 8 \quad (x^2 + 3x - 2) \\
 + 2x & 2x^3 \quad 6x^2 - 4x \\
 - 3 & \underline{-3x^2 - 9x + 6} \\
 & 3x^3 - 2x^2 \quad \underline{2x - 2}
 \end{array}$$

The object of this arrangement is to have all the terms obtained from the same term in the divisor in the same horizontal line. Thus the three quantities  $2x^3$ ,  $6x^2$ ,  $-4x$  are obtained from the  $2x$  in the divisor by multiplying it respectively by the three terms in the quotient, and the terms  $-3x^2$ ,  $-9x$ ,  $6$  are similarly obtained from  $-3$  in the divisor. This arrangement is greatly facilitated by writing the divisor in a vertical column instead of horizontally. The division may then be effected as follows:—Obtain the first term in the quotient by dividing the first term of the dividend by the first term of the divisor. The remaining terms of the divisor are then multiplied by this part of the quotient and the results placed, one under  $x^3$  and in the same horizontal line with  $2x$ , and the other under  $-5x^2$  and in the same horizontal line with  $-3$ . Then by addition  $3x^2$  is obtained, and from this we get the second term of the quotient, and then the two last terms of the divisor are multiplied by this new part of the quotient, and the results  $6x^2$  and  $-9x$  arranged diagonally as the former ones were, and so on.

But even yet two quantities occur which may be omitted. These are  $3x^3$  and  $-2x^2$ . The  $3x^3$  is used to obtain the second term of the quotient, but this may quite readily be done without writing the  $3x^3$  and thus the place now occupied by it may better be filled by the term in the quotient which it produces, and so also with the  $-2x^2$ . We shall thus have

$$\begin{array}{r|l}
 x^2 & x^4 + x^3 - 5x^2 + 15x - 8 \\
 2x & 2x^3 \quad 6x^2 - 4x \\
 -3 & \underline{-3x^2 - 9x + 6} \\
 & x^2 + 3x - 2 \quad \underline{2x - 2}
 \end{array}$$

We have now only to omit the letters, retaining the detached coefficients, and we have Horner's method.

$$\begin{array}{r|l}
 1 & 1 + 1 - 5 + 15 - 8 \\
 2 & 2 \quad 2 \quad 6 \quad -4 \\
 -3 & \underline{-3 \quad -9 \quad 6} \\
 & 1 + 3 - 2 \quad \underline{2 - 2}
 \end{array}$$

ANSWERS TO PROBLEMS FROM CORRESPONDENTS.

1. If  $a^2 + b^2 + c^2 = ab + bc + ca$  prove that  $a = b = c$

If  $a^2 + b^2 + c^2 = ab + bc + ca$ , then

$$2(a^2 + b^2 + c^2 - ab - bc - ca) = 0$$

$$\therefore (a - b)^2 + (b - c)^2 + (c - a)^2 = 0$$

$$\therefore a - b = 0, b - c = 0, c - a = 0$$

2. If  $n$  st. lines cut one another in all possible ways find the number of pts. of section.

First take two lines; these cut in one point. Next take a third line; this cuts the first two in two more points. The fourth line will cut these three in three more points, the fifth in four more, &c., till we reach the  $n$ th line, which will cut the other  $n-1$  lines in  $n-1$  points. Thus to find the whole number of points of section we shall have to find the sum of the series

$$1, 2, 3, \&c. \quad n-1$$

$$\text{which is } \frac{n}{2} (n-1).$$

Or thus:—The number of points will be the number of combinations of  $n$  things two

$$\text{together, and is therefore } \frac{n}{2} (n-1).$$

3. Shew that  $(x + y)^7 - x^7 - y^7$  is divisible by  $(x^2 + xy + y^2)^2$

The coefficients in the expansion of  $(x + y)^7$  are 1, 7, 21, 35, 35, 21, 7, 1, and on subtracting  $x^7$  and  $y^7$  these become 7, 21, 35, 35, 21, 7.

Now divide by 7, (that is,  $7xy$ ). and we get 1, 3, 5, 5, 3, 1; next divide by Horner's method and we have

$$\begin{array}{r|l}
 & 1 + 3 + 5 + 5 + 3 + 1 \\
 -1 & \underline{-1 - 2 - 2 - 1} \\
 -1 & \underline{-1 - 2 - 2 - 1} \\
 & 1 + 2 + 2 + 1 \\
 -1 & \underline{-1 - 1} \\
 -1 & \underline{-1 - 1} \\
 & 1 + 1
 \end{array}$$

leaving no remainder therefore, &c. This method has the advantage of exhibiting the quotient and hence gives all the factors, &c.



$$(x + y)^7 - x^7 - y^7 = 7xy(x + y)(x^2 + xy + y^2)^2$$

4. Solve  $x^3 + y^3 + z^3 = 1$  (1)  
 $x^2 + y^2 + z^2 = 1$  (2)  
 $x + y + z = 1$  (3)

From the cube of (3) take (1)

$$\therefore x^2y + y^2z + z^2x + xy^2 + yz^2 + zx^2 + 2xyz = 0 \quad (4)$$

From the product of (2) and (3) take (1)

$$\therefore x^2y + y^2z + z^2x + xy^2 + yz^2 + zx^2 = 0 \quad (5)$$

Subtract (5) from (4)  $\therefore xyz = 0$

$\therefore$  either  $x = 0$ ,  $y = 0$  or  $z = 0$

Suppose  $z = 0$

$$\therefore x^2 + y^2 = 1$$

$$x + y = 1$$

$\therefore xy = 0$   $\therefore$  either  $x$  or  $y$  is also  $= 0$

suppose  $y = 0$  then  $x = 1$ .

$\therefore$  one of the quantities  $x, y, z$  is  $= 1$  and the other two each  $= 0$ .

5. Solve  $x^2 - yz = a^2$  (1)

$$y^2 - zx = b^2$$
 (2)

$$z^2 - xy = c^2$$
 (3)

multiply (1) by  $y$ , (2) by  $z$ , (3) by  $x$  and add, then  $c^2x + a^2y + b^2z = 0$  (4)

next multiply (1) by  $z$ , (2) by  $x$ , (3) by  $y$  and add, then

$$+ b^2x + c^2y + a^2z = 0 \quad (5)$$

eliminating  $z$  from (4) and (5) we have

$$\frac{y}{x} = \frac{b^4 - a^2c^2}{a^4 - b^2c^2} = k \text{ suppose}$$

$$\therefore y = kx$$

eliminating  $z$  from (1) and (2) we have

$$x^3 - y^3 = a^2x - b^2y$$

put  $y = kx$ , then

$$x^2 = \frac{a^2 - kb^2}{1 - k^3}$$

$$= \frac{(a^4 - b^2c^2)^2}{a^6 + b^6 + c^6 - 3a^2b^2c^2}$$

6. Find the sum of the infinite series

$$ar + (a + ab)r^2 + (a + ab + a^2b^2)r^3 + \dots$$

$r$  and  $br$  being each less than unity.

Dividing through by  $ar$  we get

$$1 + (1 + b)r + (1 + b + b^2)r^2 + \dots$$

Denote this by  $S$ , then  $Sr$

$$= r + (1 + b)r^2 + \dots$$

Then by subtraction we have

$$S(1 - r) = 1 + br + b^2r^2 + \dots$$

$$= \frac{1}{1 - br}$$

$$\therefore S = \frac{1}{(1 - r)(1 - br)}$$

$\therefore$  original series

$$= \frac{ar}{(1 - r)(1 - br)}$$

7. Find the relation between the coefficients of the equation  $ax^2 + bx + c = 0$  that one root may be double the other.

The roots are

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

If, therefore, we put

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a} = 2 \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

we get  $2b^2 = 9ac$  as the required condition.

Or thus:—Let  $m$  and  $2m$  be the roots of the equation. Then the equation is

$$x^2 - 3mx + 2m^2 = 0$$

$$\therefore 3m = \frac{b}{a}, \quad 2m^2 = \frac{c}{a}$$

$$\therefore m^2 = \frac{b^2}{9a^2}, \quad m^2 = \frac{c}{2a}$$

$$\therefore \frac{b^2}{9a^2} = \frac{c}{2a}, \text{ or } 2b^2 = 9ac$$

Solutions to the First-class Euclid Paper given in December number of the MAGAZINE.

6. To construct a rectangle that shall be equal to a given square, and the difference of whose adjacent sides shall be equal to a given line.

Let  $b$  denote the side of the given square, and  $a$  the difference of the adjacent sides.

Draw a straight line  $AB$  equal to  $a$ ; from  $A$  draw  $AC$  at right angles to  $AB$  and make  $AC$  equal  $2b$ ; join  $BC$ ; from  $BC$  cut off  $BD$  equal  $a$  and bisect  $DC$  in  $E$ ;  $BE, EC$  shall be the sides of the required rectangle.

For, denote DE by  $c$ , then

$$a^2 + (2b)^2 = BC^2 = (a + 2c)^2$$

$$\therefore 4b^2 = 4ac + 4c^2$$

$$b^2 = ac + c^2$$

$$= (a + c) c$$

$$= BE \cdot EC$$

7. To find a point within a triangle from which, if straight lines be drawn to the angles, they will divide the triangle into three equal parts.

Let ABC be the triangle. Draw a straight line parallel to BC, cutting the perpendicular from A on BC at a point one-third of its length from BC. Then if B, C be joined to any point in this line, a triangle will be formed whose area is one-third of the triangle ABC. If then a line be similarly drawn with regard to one of the other sides of the triangle, the point where these lines intersect will be the point required.

8. Given any triangle, to make a similar one of double the area.

Let AB be a side of the given triangle; through B draw BC at right angles to AB, making BC eq. AB; join CA; on CA construct a triangle similar to the given triangle; this shall be the triangle required. For similar triangles are to one another as the squares on their homologous sides, and the square on AC eq. twice the square on AB.

10. If the perpendiculars  $Am$ ,  $Bn$ ,  $Cd$  be drawn from the angular points of a triangle ABC upon the sides, shew that they will bisect the angles of the triangle  $and$ .

Because  $\angle mB$ ,  $\angle nB$  are right angles, a circle may be described, passing through the four points A, n, m, B, therefore the angle  $\angle Bnm$  is eq. to  $\angle BAm$ . Again, a circle may be described, passing through the four points B, d, n, C, therefore the angle  $\angle dnB$  is eq. to  $\angle dCB$ ; but the angle  $\angle dCB$  is eq. to  $\angle BAm$ , for a circle may be described, passing through A, d, m, C, therefore the angle  $\angle Bnd$  eq.  $\angle Bnm$ , and similarly for the other angles.

SECOND-CLASS NATURAL PHILOSOPHY—WITH SOLUTIONS.

1. What conditions are necessary so that

three forces acting on a body may maintain equilibrium?

Shew how the following forces may be arranged so as to produce equilibrium:

(i) 4 lbs., 5 lbs. and 7 lbs. (ii)  $(\sqrt{7} + \sqrt{5})$  lbs.,  $(\sqrt{7} - \sqrt{5})$  lbs., and  $2\sqrt{7}$  lbs. (iii) 1 lb., 4 lbs. and  $\sqrt{17}$  lbs.

SOLUTION.—Draw a straight line AB; through B draw BC at right angles to AB; from centre A, with a radius equal to 5 times AB, describe a circle cutting BC in C; produce AB to D, making AD 4 times AB; through D draw DE parallel to AC, and through C draw CE parallel to AD. Forces represented by AC, AD and EA will produce equilibrium.

(ii) If the first two forces act at a point and in the same direction, and the third act at that point in the opposite direction, equilibrium will be produced.

(iii) Draw AB, AC at right angles, making AB 4 times AC; complete the rectangle ABDC. Forces represented by AB, AC and DA will produce equilibrium.

2. Examine the truth of the following statement: "If three forces acting on a body are parallel to the sides of a triangle, they will keep it at rest."

A rod AC, (supposed without weight) hinged at C, has a weight of 200 lbs. hung at A, and is kept in position by a horizontal tie-rod AB. The angle BAC is  $30^\circ$ ; find the tension of the tie-rod and the thrust along AC.

SOLUTION.—Let AD be the line in which the weight acts; draw CD perp. to AD, and CB perp. to AB, then taking moments about C we have tension in AB  $\times$  CB =  $200 \times$  CD, and if we suppose the length of AC to be 2, we shall have BC = 1, DC =  $\sqrt{3}$ ,  $\therefore$  tension in AB =  $200\sqrt{3}$ . Again, the magnitude of the thrust along AC is equal to that of the resultant of the other two forces acting at rt. ang. and therefore = 400.

3. If two sides of an equilateral triangle taken in order, 8 ft. long, represent in direction and magnitude two forces acting at a point, find two equal forces acting at an

angle of  $120^\circ$  to each other which will, with these forces, produce equilibrium.

SOLUTION.—Since the given forces are represented by the sides of an equilateral triangle, taken in order, they must act at an angle of  $120^\circ$  to each other, and hence the forces required have simply to be equal to the given forces and to act in opposite directions at the same point.

4. In a system of four pulleys, each hanging by a separate string, the weight of each pulley being 1 lb., find the relation between the power and the weight.

SOLUTION.—Let  $W$  denote the weight,  $P$  the power; then since  $\frac{1}{2}$  lb. of the power is required to support the first pulley,  $\frac{1}{4}$  lb. for the second,  $\frac{1}{8}$  lb. for the third, and  $\frac{1}{16}$  lb. for the fourth, therefore the part of the power available for supporting  $W$  is  $P - \frac{1}{16}P$ , and between them the usual relation holds;  $\therefore W = 16P - 15$ .

If a force of  $2\frac{1}{2}$  lbs. just supports a weight of 45 lbs. in such a system, and the weight of the pulleys be equal, find the weight of each pulley.

SOLUTION.—If by "such a system" is meant a system of four pulleys, the problem does not admit of a solution; but if any greater number be allowed, then each number of pulleys will give a different solution.

5. If a substance be weighed in a balance having unequal arms, and in one side appear to weigh  $m$  lbs. and in the other  $4n$  lbs., what is the true weight of the substance and what is the ratio between the lengths of the arms of the balance?

SOLUTION.—Let  $x$  be the true weight of the substance, and  $a, b$ , the lengths of the arms of the balance; then from one weighing we have

$$\frac{x}{m} = \frac{a}{b}$$

and from the other  $\frac{4n}{x} = \frac{a}{b}$

$$\therefore x = 2\sqrt{mn}$$

$$\text{and } \frac{a}{b} = \frac{x}{m} = 2\sqrt{\frac{n}{m}}$$

6. What is the ratio of the power to the weight, in the case of the inclined plane, when the power acts (i) parallel to the plane; (ii) parallel to the base.

Show that the power is most effective when acting parallel to the plane.

7. Define specific gravity, and show how to find the specific gravity of a body lighter than water.

A piece of wood weighs 4 lbs. in air, and a piece of lead weighs 5 lbs. in water, the lead and the wood together weigh 4 lbs. in water; determine sp. g. of the wood.

SOLUTION.—Since the lead weighs 4 lbs. when the wood is attached, therefore 1 lb. is needed to sink the wood, and since the wood itself weighs 4 lbs., therefore the wt. required to sink it is 5 lbs.; that is, it displaces 5 lbs. of water, and hence its sp. g. is  $\frac{4}{5}$ .

8. Describe, using diagram, the structure of the lifting pump. What determines the height to which water may be raised by means of it?

Describe the thermometer. At what temperature will the reading of the Fahrenheit thermometer be three times as great as that of the Centigrade? Give your answer in degrees Fahrenheit.

SOLUTION.—Let  $x$  be the number of degrees on the Fahrenheit thermometer, then  $\frac{3}{5}x$  is the number on Cent.

$$\therefore x - 32 = \frac{3}{5} \text{ of } \frac{3}{5}x$$

$$\therefore x = 80.$$

9. A cubical block of wood, whose edge is 18 inches and whose sp. g. is .75, is placed in water, and pressed by a force into such a position that its upper surface, which is horizontal, is just one foot below the surface of the water; find the pressure on the whole outside of the cube, and the downward force acting upon it.

SOLUTION.—The average depth of the surface of the cube is  $1\frac{3}{4}$  feet, its area  $13\frac{1}{2}$  feet,  $\therefore$  the pressure =  $13\frac{1}{2} \times 1\frac{3}{4} \times 1000$  oz. The volume of the block is  $3\frac{3}{8}$  cub. ft.,  $\therefore$  it displaces  $3\frac{3}{8}$  cub. ft. of water, but its weight is only equal to that of  $\frac{3}{4}$  of  $3\frac{3}{8}$  cub. ft. of water;  $\therefore$  the force downwards must be equal to the wt. of  $\frac{1}{4}$  of  $3\frac{3}{8}$  cub. ft. of water.

CHEMISTRY.

I.

I.—State the difference between Combining weight and Volume weight.

II.—Explain the equation :

$H_2 SO_4 + 2K OH = K_2 SO_4 + 2H_2 O$ ,  
and write out the combining numbers for each element.

The Combining weight of a substance is the least number of parts by weight which can take part in a chemical reaction, and this substance either unites with others with this number of parts by weight or some multiple of this number. The Volume weight of a substance is the weight of a given volume of that substance in the form of gas, as compared with some standard. (We use Hydrogen as the standard.)

The Combining weights and Volume weights are the same, with the exception of P, As, Cd and Hg. In the first two the Volume weight is twice that of Combining weight, and in last two, one-half of it.

The equation means that if a molecule of  $H_2SO_4$  and two molecules of  $KOH$  be brought together, a molecule of  $K_2SO_4$  Potassic Sulphate, and two molecules  $H_2O$  will be formed. That is, the Potassium of the  $KOH$  changes places with the Hydrogen of the Sulphuric Acid.

Combining numbers are

$$\begin{matrix} H = 1 \\ S = 32 \\ O = 16 \\ K = 39 \end{matrix} \left. \begin{matrix} \\ \\ \\ \end{matrix} \right\} \begin{matrix} \text{In round} \\ \text{numbers.} \end{matrix}$$

II.

I.—Deduce the formula for converting degrees on Fahrenheits scale to corresponding degrees on the Centigrade scale.

II.—Convert  $84^\circ C$  into F.

III.—Convert  $40^\circ C$  into F.

IV.—Convert  $39^\circ F$  into C.

I.—The zero point of the Fahrenheit scale is  $32^\circ$  below the freezing point of water. The boiling point of water is  $212^\circ$  removed from the zero point. The number of degrees, therefore, on the Fahrenheit scale between the freezing and boiling point of water is  $180^\circ$ .

Celsius, the inventor of the Centigrade thermometer, made the freezing point of water his zero point, and the boiling point  $100^\circ$  above this; so that 100 spaces on Centigrade corresponds with 180 spaces on the Fahrenheit, and as  $0^\circ C$  corresponds to  $32^\circ F$ . to change degrees of C to degrees of F we must add the  $32^\circ$ ; and in changing from F to C we must subtract the  $32^\circ$ , hence

$$\frac{9}{5} C = F + 32, \text{ and}$$

$$\frac{5}{9} F - 32 = C$$

$$\text{II.} - \frac{9}{5} \text{ of } 84^\circ + 32^\circ = \frac{756^\circ}{5} + 32^\circ \text{ or } 182\frac{1}{5}^\circ F.$$

$$\text{III.} - \frac{9}{5} \text{ of } 40^\circ + 32^\circ = 72^\circ + 32^\circ = 104^\circ F.$$

$$\text{IV.} - \frac{5}{9} \text{ of } (-30^\circ - 32^\circ) = \frac{-310^\circ}{9} = -34\frac{4}{9}^\circ C.$$

III.

I.—State and explain the laws relating to the variation in the volume of a gas, for variation in temperature or pressure.

II.—100 volumes air under a barometric pressure of 740 min. become how many volumes when under a pressure of 750 min. ?

III.—A quantity of air at  $0^\circ C$ , what will be its volume at  $185^\circ F$  ?

I.—For temperature—Gay.Lussac's law—for every increase of one degree C in temper-

ature a gas expands  $\frac{1}{273}$  of the volume it occupies at 0°. That is if a gas at 0° C occupies 273 volume, at 1°, it occupies  $273 + \frac{1}{273}$  of 273 or 274 volumes, at 2° it occupies  $273 + \frac{2}{273}$  of 273 or 275 volumes, etc.

But Magnus and Regnault shewed that Hydrogen expands less than air, and Carbonic Dioxide more.

For pressure—Boyle's or Marriotis' law, viz: that the volume occupied by a gas is inversely proportional to the pressure to which it is subjected.

For instance, a gas which occupies 1 volume at any pressure becomes  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , &c. volume when subjected to pressure twice, thrice, four times, &c. as great, and twice, thrice, &c. the volume at a pressure of  $\frac{1}{2}$ ,  $\frac{1}{3}$ , &c. as great.

II.—According to Boyle's law—1 volume air at a pressure of 740 min. becomes  $\frac{740}{750}$  at a pressure of 750 min., and 100 volumes air at a pressure of 740 min. become  $\frac{740}{750} \times 100$  or  $\frac{296}{3}$  or 98 $\frac{2}{3}$  volumes.

III.—According to Lussac's law—1 CC. at 0° C becomes  $\frac{273+18.5}{273}$  CC. at 18.5° C. and

100 CC. at 0° C becomes  $\frac{273+18.5}{273} \times 100$  CC.

at 18.5 and  $\frac{273+18.5}{273} \times 100 = 106 \frac{212}{273}$  CC.

#### IV.

I.—How is Carbonic acid prepared?

II.—Give and explain the equations representing the reaction.

III.—Describe fully what takes place when a stream of Carbonic acid is led into lime water to saturation, also what occurs when the liquid so produced is boiled.

IV.—How would you prove that Carbonic acid really consists of Carbon and Oxygen in the proportion stated in the formula?

I.—Most common method is to pour Muriatic acid upon some Carbonate, for instance, marble, chalk or limestone.

II.—The following equation represents

reaction of  $\text{CaCO}_3$ :  $\text{CaCO}_3 + 2\text{HCl} = \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ . The H changes places with the Ca, and  $\text{H}_2\text{CO}_3$  is formed, but it is very unstable and immediately splits up into  $\text{H}_2\text{O}$  and  $\text{CO}_2$ .

You may use any strong acid and any metallic Carbonate.

II.—Lime water is  $\text{Ca}(\text{OH})_2$  dissolved in  $\text{H}_2\text{O}$ . When  $\text{CO}_2$  is first led into this lime water, the insoluble Calcic Carbonate,  $\text{CaCO}_3$  is formed and precipitated. When an excess is led into the soluble Calcic Carbonate,  $\text{CaH}_2(\text{CO}_3)_2$  is formed and dissolved. On boiling the liquid, the soluble Carbonate splits up into the insoluble Carbonate, which is thrown down. Water and Carbonic Dioxide, the  $\text{CO}_2$ , escapes as a gas.

IV.—Burn charcoal in a known volume of O in excess. On cooling the gas, no alteration in volume occurs, hence  $\text{CO}_2$  contains its own volume of O, and therefore a molecule contains two atoms O. The composition by weight can be shown by burning a known quantity of pure Carbon (Diamond or Graphite) in a current of O gas, and weighing the  $\text{CO}_2$  produced.

#### V.

I.—What are the principal ores of Tin Iron, Lead, Copper and Zinc?

II.—Describe the process of smelting any one of them.

I.—Of Tin the only important one is tin-stone  $\text{SnO}_2$ .

Of Iron, the black Oxide  $\text{Fe}_3\text{O}_4$ , the red Oxide or Hæmatite  $\text{Fe}_2\text{O}_3$ , Ferrous Carbonate or clay ironstone  $\text{FeCO}_3$ , and iron pyrites  $\text{FeS}_2$  are the most important.

Of Lead, the only important one is the Sulphide or Galena  $\text{PbS}$ .

Of Copper, copper pyrites  $\text{Cu}_2\text{S} + \text{Fe}_2\text{S}_3$  and the Carbonate or Malachite  $\text{CuCO}_3$  are the principal ones, but it is found native in quartz rock.

Of Zinc, the carbonate called Calamine  $\text{ZnCO}_3$ , and the Sulphide or Blende  $\text{ZnS}$ .

II.—For description of smelting

Iron ore see "Roscoe," p. 200, l'n XXII  
 Tinstone see "Roscoe," p. 205, l'n XXIII.  
 Zinc ore see "Roscoe," p. 192, l'n XXI.  
 Copper ore see "Roscoe," p. 221, l'n XXV.  
 Lead ore see "Roscoe," p. 216, l'n XXIV.

We will describe the smelting to obtain Zinc:

The powdered ore is wasted, or exposed to air at a high temperature, to convert the Sulphide or Carbonate into the Oxide; The wasted ore is then mixed with charcoal, and strongly heated in crucibles or retorts. Zinc Oxide is reduced by the Carbon—Carbon Monoxide escaping as a gas. The Zinc distils over and may be condensed.

VI.

I.—Give the formulas for the two Carbonates of Sodium.

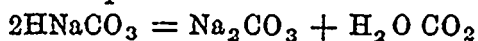
II.—Explain how the one may be obtained from the other.

III.—How much neutral Carbonate will one pound of the Bicarbonate produce?

I.—The neutral Carbonate is  $\text{Na}_2\text{CO}_3$   $10\text{H}_2\text{O}$  that is crystallizes with 10 molecules  $\text{H}_2\text{O}$  of crystallization. The Bicarbonate is  $\text{HNaCO}_3$ .

II.—Pass  $\text{CO}_2$  through a solution of neutral Carbonate, and the Bicarbonate is produced; or, pass  $\text{CO}_2$  over trays containing the efflorescent neutral Carbonate and the Bicarbonate is produced.

III.—Heat the  $\text{HNaCO}_2$ , and  $\text{Na}_2\text{CO}_3$  is formed. Equation is as follows:



Or, 168 parts by weight  $\text{HNaCO}_2$  gives 106 parts by weight of  $\text{Na}_2\text{CO}_3$ ; 1 lb. accordingly give

$$\frac{106}{168} \text{ or } \frac{53}{84} \text{ lb. } \text{Na}_2\text{CO}_3.$$

VII.

I.—Describe the general qualities of an Alkali.

II.—Explain the action of Soda with Hydrochloric Acid, Sulphuric Acid, Zinc Sulphate and Stearine.

I.—The Alkalies united with water give a peculiar taste resembling that of soap or

washing soda, but it is neither salt, bitter nor sour. Their action on certain vegetable coloring matter is the opposite to that of acids, that is, they turn red litmus blue; red cabbage green, etc.; Neutralize acids, that is form Neutral Salts with them. They absorb and combine with  $\text{CO}_2$ .

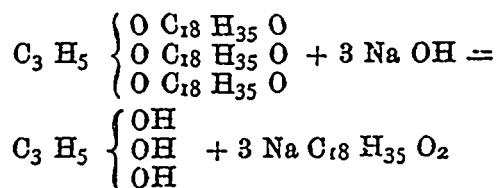
II.— $\text{NaOH} + \text{HCl} = \text{NaCl} + \text{H}_2\text{O}$ , the Na of the  $\text{NaOH}$ , replaces the H in the  $\text{HCl}$  and common salt is formed

(a)  $\text{NaOH} + \text{H}_2\text{S}'\text{O}_4 = \text{HNaS}'\text{O}_4 + \text{H}_2\text{O}$  or the Sodium replaces one atom of H in the Sulphuric Acid and Hydrosodic Sulphate is formed.

(b)  $2\text{NaOH} + \text{H}_2\text{S}'\text{O}_4 = \text{Na}_2\text{S}'\text{O}_4 + 2\text{H}_2\text{O}$ . In this reaction both atoms of H in the Sulphuric Acid are replaced by Sodium—the reaction requiring more heat.

(c)  $2\text{NaOH} + \text{ZnSO}_4 = \text{Zn(OH)}_2 + \text{Na}_2\text{SO}_4$  In this reaction Zinhydroxide is precipitated—Sodium Sulphate remaining in solution.

The action of Soda on Stearin consists in the formation of an Alkaline Stearate and the liberation of Glycerin. For illustration we shall make use of the Tristearin:



Popularly speaking the reaction consists in the formation of Glycerin  $\text{C}_3 \text{H}_5 (\text{OH})_3$  and SOAP or Sodium Stearate  $\text{Na C}_{18} \text{H}_{35} \text{O}_2$

VIII.

I.—What is meant by graphic, simple and constitutional formulæ? Give illustrations.

II.—Give the graphic formulæ for Phosphoric Chloride and Sulphuric Acid.

III.—Give the formulæ, simple and constitutional, of Common Salt, Lead Peroxide, Iron Peroxide and Silver Phosphate.

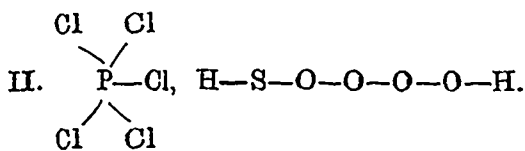
I.—The Simple or Empirical formulæ are those in which the constituent elements are written down together. It shews the number of atoms of each substance in the compound, as  $\text{H}_2\text{SO}$  shews that there are 2H, one S

and 4O united to form a compound.

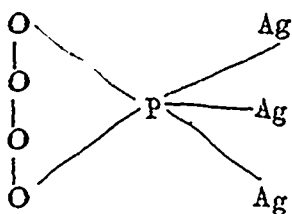
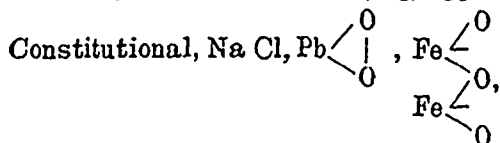
The Constitutional or Rational formulæ of a substance shews (as the name indicates) the constitution or structure of the compound, as  $H_2SO_4$ , to shew its structure we write  $SO_3 = H_2O$ , as it can be formed by a union of these two.

The Graphic formulæ treats more especially of the valency of bodies; it shews the chemical attraction which binds the structure together, as  $H_2SO_4$  graphically would be represented  $H-S-O-O-O-O-H$ .

The first H extends one arm (being a monad) which is satisfied by one arm of the dyad S; the other arm is satisfied by one arm of the first O, and each succeeding O satisfies the arm left uncombined by preceding one till last one is reached, and H meeting with that, binds the substance together.



III.—Simple,  $NaCl, PbO_2, Fe_2O_3, Ag_3PO_4$



IX.

I.—Give an example of a Monobasic, a Dibasic and a Tribasic acid.

II.—What is the nature of the decomposition which takes place when a solution of Silver Nitrate is added to one of common Sodium Phosphate?

I.—A Monobasic acid has one replaceable atom of Hydrogen,  $HNO_3 HCl H_3 HO_2$ .

A Dibasic has two,  $H_2 SO_4 H_2 Se F_6 H_3 PO_4$ .

A Tribasic has three,  $H_3 As O_4 H_3 PO_4$ .

II.— $3Ag NO_3 + HNa_2 PN_4 = 2NaNO_3 + HNO_3$  when the solution is added, a bright yellow precipitate is thrown down consisting of  $Ag_3 PO_4$  that is, the Silver changes place with the H and the Na, owing to the fact that Silver replaces all the replaceable H in a Hydrogen Salt if it replaces any.

The remaining liquid will give an acid reaction, owing to the formation of  $HNO_3$ . As the Nitric formed holds some of  $Ag_3 PO_4$  in solution, it will be necessary to neutralize the liquid if we wish to precipitate all  $Ag_3 PO_4$ .

Calculate the most probable formula for a substance containing no other elements but C, O and H, of which .243 grain yielded on combustion .693 grain of Carbonic Dioxide and .162 grain  $H_2 O$ .

44 grs. $CO_2$ contains	12 grs. C.
1 " " "	$\frac{3}{11}$ " C.
.001 " " "	$\frac{3}{11000}$ " C.
.693 " " "	$\frac{189}{1000}$ or .189 grs. C.
18 grs- $H_2 O$ contains	2 grs. H.
1 " " "	$\frac{1}{9}$ " H.
.001 " " "	$\frac{1}{9000}$ " H.
.162 " " "	$\frac{18}{1000}$ or .018 grs. H.

There are .189 grs. C and .018 grs. H, therefore, remainder or .243 — (.189 + .018) or .036 grs. O.

Weight of substances are as

C H O  
189 18 36 divide by atomic weight and we have the number of atoms, as

$15\frac{3}{4}$  C, 12 H and  $2\frac{1}{2}$  O, or

63 C, 72 H and 9 O, or

7 C. 8 H and 1 O.

Formula is most probably  $C_7 H_8 O$  or  $C_7 H_7 (HO)$  or cresol.

COUNTY OF PEEL PROMOTION EXAMINATIONS.

Second Class—Promotion to Third.

WRITING.

(Script, on paper.)

Values

50 Second Reader—page 176  
--“Poor Tom—get my boat  
for me.”

50 Second Reader—page 8—  
first two verses of “Kitty  
and Mousie.”

SPELLING.

(Separate seats—paper—deduct five marks for  
each error.)

Values

100 “A little child would grieve  
to lose it.” “To-morrow I  
will go to the brazier’s.”  
“Those who heed his treach-  
erous wooing.” “Drifting  
snows my tomb prepare.”  
“Two bullets through his  
head.” “Willie had neither  
sieve, corn, nor halter.” “If  
he steadily perseveres he will  
be sure to succeed.” “They  
chased the gaudy butterflies  
until they were tired.” “Brave  
and determined in spite of  
all obstacles.” “Pleasant  
indeed was the change it  
wrought.”

ARITHMETIC.

(Full work—on paper.)

Values

6+4 1. From the sum of six  
+4 millions two thousand and  
sixty-seven, eight millions

Values.

twenty thousand and six,  
ninety thousand and seventy-  
five, and forty-three millions,  
nineteen thousand and four-  
teen take the product of 4046  
and 7402.

7+7

2. From 829346591126 take  
621195643928 and divide the  
remainder by seven.

10

3. Express 319, 465, 797,  
999 and 333 in Roman  
numerals.

15

4. A boy fishing caught  
two dozen and four trout, 16  
shiners, and half a score black  
bass; he sold the trout at 5c.,  
the shiners at 2c., and the  
black bass at 7c. each; how  
much did he get for his fish?

15

5. If I trade  $3\frac{1}{2}$  tons of hay,  
worth \$1 a cwt., for potatoes  
worth 35c. a bushel, how  
many bushels should I get?

15

6. If a man earns \$30 a  
month and spends \$100 a  
year for board, and \$80 a year  
for other expenses, how many  
years will it take him to  
save \$1800?

15

7. A man died this year  
103 years old, in what year  
was he born?

LOCAL GEOGRAPHY.

(On paper.)

Values

26

1. Draw a map of the  
School Section in which you



Values	
	live, showing the public roads, the streams, the position of the school-house, and of your own house.
12	2. In what Township is Brampton? Bolton? Streetsville? Alton?
12	3. In what direction from your school-house is Lake Ontario? Credit River? Brampton? Grand Trunk Railway?

Third Class—Promotion to Fourth.  
READING.

Values	
50	Third Reader—page 287— “The page made an apology— —filial love.”

## SPELLING.

(On paper—from dictation—five marks off for each error in spelling, including use of capital letters—begin each phrase or sentence with a new line.)

Values	
160	“The soldier of the legion in a foreign land.” “People enjoying a delicious temperature of air.” “Where furious Frank and fiery Hun shout in their sulph’rous canopy.” “Oh! we’d rather lose our other two than have him here again.” “Threatening instant annihilation to those who should attempt to recede.” “Fastened round their waist with scarlet worsted belts.” “You’re uncommon good-hearted little beggars, you two.” “The patriarch gives them lessons in topographical engineering.” “She returned to her philosophical mat for sympathy.” “It has been owing to the two days’ labor in that abominable ditch.”

## COMPOSITION.

Values	
50	1. Re-write—Third Reader page 288—“This story—filial love,” substituting, wherever possible, words and phrases of your own for those in the text.
59	2. The Skater and the Wolves—Fourth Reader, page 115.

(Teachers will read the above lesson to candidates, who will thereafter write its substance as much as possible in their own language.)

## WRITING.

Values	
50	First two verses of “John Gilpin,” page 304.

## ARITHMETIC.

Values	
10	1. Find the difference between four hundred and seven times eight thousand and forty and $3582267648 \div 48$ in factors.
10	2. Divide $9 \times 7 \times 16 \times 16 \times 1$ by $21 \times 32 \times 2$ .
10	3. What is the highest common factor of 144, 676, 720; also of 6006 and 3318.
10	4. Simplify $\frac{1}{8}$ of $\frac{2}{15}$ of $3\frac{1}{10}$ of 6.
10	5. Reduce to their lowest common denominator the following fractions: $22\frac{1}{4}$ , $7\frac{1}{5}$ , $3\frac{2}{3}$ , $4\frac{1}{12}$ .
10	6. A boy having $\frac{2}{8}$ of a dollar spends $\frac{3}{8}$ of it: how many cents has he left?
10	7. A grocer sells 2000 box-

Values  
 \_\_\_\_\_  
 es of strawberries at 4 for 25 cents, gaining \$25 in all: how much did he pay for the berries?

10 8. If potatoes are worth 45 cents a bag of a bushel and a half, for how much should I sell the potatoes, growing on an acre and a half of land, producing at the rate of 150 bushels an acre?

10 9. How many squares of shingles (100 feet to square) will cover a barn roof, one of whose two equal sides is 80 feet long by 25 feet wide?

10 10. Suppose a seed drill to be 9 feet wide, how many yards must it run to sow an acre?

### GEOGRAPHY.

16 I. (a) Draw a map of North America.

4 (b) Tracing the course of the Mackenzie, St. Lawrence with the lakes of which it is the outlet, and Mississippi.

4 (c) Locating each capital of a British Province, and the cities of New York, San Francisco, New Orleans, Boston, St. Louis, Chicago and Washington, in the United States.

6 (d) Showing Newfoundland, Cuba, Yucatan, Farewell, Vancouver and Labrador.

20 2. In what Counties and on what Railroads are the following respectively situated: Hamilton, Kingston, London, St. Catharines, Brantford,

Values  
 \_\_\_\_\_  
 Stratford, Guelph, Toronto, Ottawa, Orangeville.

15 3. What and where are the following, respectively: Fredericton, Grand, Race, Cleveland, Great Salt, Winnipeg, Florida, Fraser.

### GRAMMAR.

20 1. Parse:—On her white breast a sparkling cross she wore.

25 2. Divide the following sentences into subject and predicate:

(a) The sun from the western horizon extended his golden wand o'er the landscape.

(b) From crag to crag leaps the live thunder.

(c) Comrade, will you give me a lift?

(d) Sweet are the uses of adversity.

(e) One man in his time plays many parts.

9 3. Define:—Noun, Verb, Adverb, Mood, Tense, Inflection.

8 4. Write out the plurals of the following nouns: (a) lady, valley; (b) wolf, dwarf; (c) footman, roman; (d) fox, ox.

6 5. Write out the possessive case, singular and plural, of the following nouns: (a) man; (b) bee; (c) boy.

6 6. Write out five common nouns, and prefix to each a suitable adjective of quality.

9 7. Give a list of six prepo-

Values  
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 sitions followed by a personal pronoun.

- 5 8. Give the superlative degree of the following adjectives: (a) good; (b) bad; (c) little; (d) old; (e) numerous.
- 12 9. Correct the following: (a) I done it lust like he did; (b) Tom likes these kind of apples; (c) he has six hats and neither of them is large enough; (d) I have never saw so many good boys; (e) a large number of children were drowned in the river;

### ADMISSION TO HIGH SCHOOLS

DECEMBER EXAMINATION, 1880.

*Being from the Fourth to the Fifth Class, public school course.*

### GEOGRAPHY.

*Time—one hour and a half.*

- Values  
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- 8 1. Define—Isthmus, Promontory, Beach, Bay, Inlet, Sound, Roadstead, Strait.
- 10 2. Name and give the boundaries of the Zones. What determines the two Tropics and the two Polar Circles?
- 9 3. Define—Latitude, Longitude, First Meridian. What is the greatest latitude a place can have? The greatest longitude? Why?
- 9 4. Give, with their boundaries, the political divisions of North America.
- 9 5. Name, giving their relative positions, the Divisions

Values  
 \_\_\_\_\_  
 of British North America. Which of these are comprised in the Dominion of Canada, and what are their Capitals?

- 9 6. Make a list of the principal rivers of Ontario, telling into what body of water each flows.
- 9 7. Give the boundaries of Asia, and the relative positions of its chief political Divisions.
- 9 8. Draw an outline map of Ireland, and mark the position of Dublin, Belfast, Cork, and Limerick.

### COMPOSITION.

*Time—one hour and a quarter.*

- 10 1. Vary the form of the following sentence in as many ways as you can, keeping the ideas:—"It was not so much the lateness of the hour, as the solitude and desolation of the place, that terrified me."
- 20 2. Re-write this passage, with proper spelling, punctuation, and capitals where they should be:—  
 The siege and storming of delhi was the most ilustrious event that occured in the coarse of that gigantic struggle the leguer or lucknow during which the mear skeleton of a british regiment the 32d held out for six months against 200 thousand armed enemeys has perhaps excited more intense intetest but delhi was the feet of arms of which brijton has most cause to be proud there too the british

Value: were really the besieged though ostnnsably the siegers they were a near handful of men more than 3700 bayonets assailed 75 thousand men trained to european dissipline by englisen officers death wounds and feaver failed to turn them from there purpose thirty times they were attacted by overwhelming no's and thirty times did they drive the enne-my behind their defenses.

10 3. Correct the composition in these sentences :

(a) I never have and never will adopt this practice.

(b) He had thus lost his opportunity which never again returned not even for a moment.

10 4. Show the different meanings that may be conveyed by each of the following :—  
"I cannot find one of my books." "Every one is unwillingly deprived of his property."

20 5. Write a short letter asking a friend to pay you a visit.

### ENGLISH GRAMMAR.

*Time—two hours.*

39 1. Parse—"The Europeans were hardly less amazed at the scene which presented itself to their view."

9 2. Analyse—  
"Beneath, in the churchyard, lay the dead,  
In their night encampment on the hill."

12 3. Write the plural and the

Value: possessive singular of John, James, and King of England ; and the third singular present indicative active of deny, crow, dye, cross, box, shock.

12 4. Define *Comparative Degree, Relative Pronoun, Adverb, and Participle.*

28 5. Correct what is wrong in the following sentences, giving your reason in each case :—

I find them in the garden.

For there's many hereabout.

Let every child bring their books to-morrow.

All persons writing or defacing the walls will be expelled.

Why are you sorry for him ?

Have either of you a pencil ?

He said it was to be given to either you or I.

You or I are to go.

### ARITHMETIC.

*Time—two hours.*

10 1. Define—*Number, Numeration, Notation, Addend, Minuend.*

10 2. Find the G. C. M. of sixty-eight million five hundred and ninety thousand one hundred and forty-two, and eighty-five million forty-four thousand and fifty-nine.

16 3. For a voyage of 17 weeks a ship takes provisions to the amount of 48 tons 4 cwt. 2 qrs. 20 lbs. 9 oz. Supposing that there are 73 men aboard, how much may be allowed each man per day ?

Values	
	from one extreme to another, they now pronounced the man whom they had so lately reviled and threatened to be a person inspired by Heaven with a sagacity and fortitude more than human, in order to accomplish a design so far beyond the ideas and conception of all former ages."— <i>Fourth Reader, p. 48.</i>
10	(i.) Explain the meaning of 'incredulity,' 'reviled,' 'sagacity,' 'fortitude,' 'accomplish.'
4	(ii.) Explain the meaning of 'obstructed the prosecution of his well-concerted plan.'
4	(iii.) <i>Passing in the warmth of their admiration from one extreme to another.</i> Tell what the two extremes were.
2	(iv.) Why is 'Heaven' printed with a capital H?
10	4. Distinguish between mite and might, pore and pour, frees, frieze and freeze, seem and seam, hoer and hoar.
6	5. Give two meanings for each of the following words: mine, pine, club.

## ENGLISH HISTORY.

Time—one hour and a half.

Values	
12	1. Tell how William the Norman came to be king of the English, and how he made his rule very strong.
12	2. What is meant by the expressions—'to do homage,' 'self-taxation,' 'feudal tenant,' 'ministers of the crown,' 'prime minister'?
12	3. What was the cause of the troubles between King Charles I. and his Parliament, and to what did they lead?
12	4. Show how England and Scotland came to be one kingdom, and how the union did good to both.
12	5. Tell what you know about the war against the American colonies in the reign of George III., and its results.
12	6. What do you understand by Free Trade, Limited Monarchy, the Whig Party?

## SCHOOL ITEMS.

In one of the Port Hope Primary Schools the plan has been adopted of having one-half the pupils come in the forenoon, and the other half in the afternoon only. They are the youngest pupils. This is from lack of school accommodation, and is expected to be temporary. School accommodation for all children over five years of age is ne-

cessary, according to Department regulations. Some communications requesting the Department to allow an age greater than five as the minimum School age have been laid on the table, no answer, other than an acknowledgment of their receipt, having been returned.

Complaints are made that the Head

Values  
16 4. Find the amount of the following bill:— $14\frac{3}{4}$  lbs. beef at 10 c.,  $12\frac{1}{2}$  lbs. pork at  $9\frac{1}{2}$  c., 3 turkeys, weighing in all  $35\frac{1}{2}$  lbs., at  $12\frac{1}{2}$  c. per lb.; 12 lb. 10 oz. lard, at 15c. per lb.; 5 geese, weighing in all 45 lb. 12 oz., at 10c. per lb.

16 5. Simplify—  

$$\frac{5\frac{3}{5} \text{ of } \frac{3}{15} + 3\cdot 3 \text{ of } 2 - 1\frac{1}{2}}{\frac{1}{7} \text{ of } (2.045 - .5)}$$
 of  

$$\frac{\text{£ } 19 \text{ } 16\text{s. } 7\frac{3}{4}\text{d.}}{\text{£ } 20 \text{ } 16\text{s. } 8\frac{3}{4}\text{d.}}$$

16 6. What is the weight of a block of stone 12 ft. 6 in. long, 6 ft. 6 in. broad, and 4 ft.  $1\frac{1}{2}$  in. thick, when a block of the same kind of stone 2 ft. 6 in. long, 3 ft. 9 in. broad, and 1 ft. 3 in. thick, weighs 1875 lbs.?

16 7. A man, after paying an income tax of  $15\frac{1}{2}$  mills in the dollar, and spending  $\$3.37\frac{1}{2}$  a day, is able to save  $\$1230.87\frac{1}{2}$  a year (365 days). Find his gross income.

### DICTIONATION.

Time—twenty minutes.

(Two marks to be deducted for every misspelled word.)

22 A. A group of stately figures wrapped in rich military cloaks, with helms glistening in the torchlight, and plumes streaming on the wind, struggle onward beside the litter.

B. Inspired by their poets, and cheered on by a superstitious belief in the prophecies of their soothsayers, they

Values never thought of yielding, even when they had lost the power of resistance.

C. In spite of the great disparity of the opposing armies and the formidable preparations made by the enemy, General Brock prepared to carry the fort by assault.

### FOURTH BOOK AND SPELLING.

Time—one hour and a half.

18 I. Write an account of the deliverance of Germany by Hermann.

2. "The disasters of Napoleon's Russian campaign have been portrayed by French writers, who were eye-witnesses of this signal defeat of blind ambition and the insane lust of conquest."—*Fourth Reader*, p. 228.

2 (i.) Who was Napoleon?

2 (ii.) About how long ago did he live?

8 (iii.) Explain the meaning of 'disaster,' 'campaign,' 'signal,' 'lust.'

2 (iv.) Which side burnt Moscow?

4 (v.) Tell what happened to the French in this campaign after the burning of Moscow.

3. "They implored him to pardon their ignorance, incredulity and insolence, which had created him so much unnecessary disquiet, and had so often obstructed the prosecution of his well-concerted plan; and passing, in the warmth of their admiration,

Master of the Public School, Port Hope, has his time taken up largely by Model School pupils to the detriment of his own, and that the \$100 from government and \$100 from the county annually granted is not adequate remuneration for the time so occupied. It is claimed that \$500 worth of work is done. The Department has been asked either to make the annual appropriation \$400, or else relieve the town from the necessity of having a Model School.

The attendance at Newmarket High School has been larger during the past session than for the corresponding term in any preceding year. There is a large class reading for the Intermediate, while others are being prepared for Matriculation in different universities. Both the masters have been re-engaged for the ensuing year at advanced salaries.

MR. GRIP is proud to hear that his old *alma mater*, the Whitby High School, has just arrived at the dignity of a Collegiate Institute. The school has always borne a splendid reputation, having fortunately enjoyed a line of first rate head-masters to wit:—James Hodgson, now P. S. I., South York; Wm. McCabe, LL. B., Thos. Kirkland, M. A., S. Arthur Mailing, M. A., now High School Inspector, and its present talented preceptor, G. H. Robinson, M. A. May the fame of the grand old institution never grow dim! *Per aspera ad alta.*—Grip.

The Gananoque High School is in a very prosperous state, and appears to be well on the road to join the front rank of Canadian Schools. A new stone building has recently been erected on a beautiful site overlooking the river, and within a short distance of the centre of the town. For a time this school suffered in no small degree from the poor state into which the local

public schools had been allowed to fall; but within the past year a great improvement has been visible, and the chances are good for a very respectable class of entrance candidates. At present a large part of the senior students is from the country—many of them teachers preparing for higher certificates.

The Brockville High School at the last Intermediate Examination holds a better position than at any time since the institution of these department examinations. In July, 1879, only 1 out of 17 pupils was successful, while in 1880 7 out of 9 gained certificates, viz.:—1 A, 5 B's and 1 intermediate grade. The percentages in most subjects have been increased, while in some, such as Algebra, Euclid, Chemistry and History the percentages have more than doubled. A new head master will take charge of the school after the Christmas vacation, and with a good staff of assistants fresh vigor will be infused, and the teachers of Leeds will have the best of opportunities to prepare for examination for certificates.

"Education" thus replies to the statement that "the support of the schools by the forced contributions of the rich gives that class the right to manage the schools."

In dilating upon this fact the writer speaks of the poor as having sold their birthright for a mess of pottage. What birthright? The right and responsibility of superintending the education of his children? What a hardship must be to the British factory-hand, or navy, that he cannot turn his giant intellect and abundant leisure to the task of grading his children up to certain "standard," in conformity with the provisions of the "code." True, this clergyman and gentlemen, with a limited number of ladies, monopolize school-board honors; but they are

there by the suffrage of the rate-payers and householders, and the mode of election, the cumulative, permits all shades of sectarianism to be represented, a system which approaches pure democracy as closely as it is possible to approach it in a densely populated district. The canons of education are so generally accepted, that, except in the matter of denominational bias, it is scarcely possible for a parent to be misrepresented on a school board, and the omission of all denominational instruction is a measure that can be contemplated with complacency in many portions of the world.

Moreover, this whole argument is

founded on the assumption that the poor contribute nothing towards the education of their children, which is not the fact. They pay taxes in the ale they drink, as well as in the money they hand to the tax-gatherer. The amount, according to their individual means, is as great, and in the aggregate it is greater. Besides, it is from their sweat that value is created, whether on the harvest-field or in the shop, and there is a margin of profit in the product of their labor for which they never receive credit, and on which those who appropriate it can well afford to pay the tax.

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### THE "BYSTANDER" ON EDUCATIONAL MATTERS.

Of the subjects of comment (ever remarkable for their wide range and scholarly handling) in the new number of the *Bystander*, two will be found of supreme importance to our readers, viz.: those entitled "Public Education in Ontario," and "Upper Canada College." Both are referred to in view of their forming the subjects of debate in the forthcoming session of the Ontario Parliament. They are treated of briefly but suggestively, and with a conservatism of utterance befitting the importance of the subjects, and manifesting mature and thoughtful views in regard to them. Disavowing any desire to sit in judgment upon the educational administration of the Province, the distinguished writer expresses the opinion that as our school system has in some degree been experimental, "the time for reviewing the results of the experiment may have come." With this apology, in a few sentences, he touches upon the cost of our school system, the programme of studies, over-education, co-education, the

danger of over-crowding the professions and other aspects of the subject of a disturbing and disquieting character—adding "that a Commission of Inquiry would not be premature, and might be of use, at all events, in dissipating misgivings, if they are unfounded, and assuring us that we are in the right path." Referring to the Executive of the Department, the writer deprecates "the connection of education with politics and cabinet government," and truly says, that the experiment of a Minister of Education "has not been wholly successful." He adds that "there are some who think it advisable to restore the Council of Public Instruction, or to institute some body of experts, mature in judgment, unconnected with politics, and placed above the suspicion of outside influence, for such functions as it might be fitted to perform." There can be little doubt, indeed of the urgency of action in this direction, which we ourselves have repeatedly suggested.

With regard to Upper Canada Col-



lege, the learned writer correctly affirms that "it is difficult to vindicate on principle the duplicate system of local High Schools combined with a great central college for the same class of pupils. The College is, in fact," he adds, "a survival from the educational era before High Schools," and, reading between the lines, there is little difficulty in concluding that the writer's opinion is that the institution should be abolished. This inference is strengthened by the remark, with which the writer concludes, that the endowment, should it be placed at the Government's disposal, would be wisely expended in forming a College for Women, "where Art of every kind and grade, music, and everything else specially pertaining to female culture might be taught." — *Canada Educational Monthly*.

### ODD TITLES OF OLD BOOKS.

MOSTLY PUBLISHED IN THE TIME OF CROMWELL.

A Fan to drive away Flies : a theological treatise on Purgatory.

A most Delectable Sweet Perfumed Nosegay for God's Saints to Smell at.

A Pair of Bellows to blow off the Dust cast upon John Fry.

A Proper Project to Startle Fools : Printed in a Land where Self's cry'd up and Zeal's cry'd down.

A Reaping-Hook, well tempered, for the Stubbon Ears of the coming Crop : or, Biscuit baked in the Oven of Charity, carefully conserved for the Chickens of the Church, the Sparrows of the Spirit, and the sweet Swallows of Salvation.

A Sigh of Sorrow for the Sinners of Zion, breathed out of a Hole in the Wall of an Earthly Vessel, known among Men by the Name of Samuel Fish (a Quaker who had been imprisoned.)

A shot aimed at the Devil's Head-Quarters through the Tube of the Cannon of the Covenant.

Crumbs of Comfort for the Chickens of the Covenant.

Eggs of Charity, layed by the Chickens of the Covenant, and boiled with the Water of Divine Love. Take Ye and eat.

High-heeled Shoes for Dwarfs in Holiness.

Hooks and Eyes for Believers' Breeches.

Matches lighted by the Divine Fire.

Seven Sobs of a Sorrowful Soul for Sin, or the Seven Penitential Psalms of the Princely Prophet David ; whereunto are also added, William Humius' Handful of Honeysuckles, and Divers Godly and Pithy Ditties, now newly augmented.

Spiritual Milk for Babes, drawn out of the Breasts of both Testaments for their Souls' Nourishment : a catechism.

The Bank of Faith.

The Christian Sodality : or, Catholic Hive of Bees, sucking the Honey of the Churches' Prayer from the Blossoms of the Word of God, blowne out of the Epistles and Gospels of the Divine Service throughout the year. Collected by the Puny Bee of all the Hive not worthy to be named otherwise than by these Elements of his Name, F. P.

The Gun of Penitence.

The Innocent Love : or, the Holy Knight : a description of the ardors of a saint for the Virgin.

The Shop of the Spiritual Apothecary ; or a collection of passages from the fathers.

The Sixpennyworth of Divine Spirit