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# THE SCHOOL MAGAZINE.

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DECEMBER, 1881.

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HEALTH DEPARTMENT.

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

## BAD EFFECTS OF TOBACCO ON THE YOUNG.

THE well-worn subject of the injuriousness of tobacco has again come to the front. This time, however, it presents a phase of much more than ordinary importance.

Certain English medical journals have been giving a partial endorsement of the weed, protesting that, on the whole, it is rather a boon than a bane to mankind. An exception is uniformly made, however, to its use by the young, and at this point Dr. Gihon appears, and in the annual report of the Surgeon-General of the Navy, presents most strongly the evils wrought upon the young by smoking.

The case of the human organism against tobacco is made out by Dr. Richardson and others to be something as follows:

In smoking tobacco we take in carbonic acid and carbonic oxide, several ammonias, and an oily substance which is crude nicotine. In this crude nicotine are nicotine proper, a volatile empyreumatic substance and a bitter extract. The ammonias and the nicotine especially are the substances which so sadly poison the system, and they act in numerous directions:

1. The ammonias, entering the blood, make it too alkaline and fluid, thus interfering with its proper nutritive activity.
2. The stomach is debilitated and dyspepsia induced by the general influence of the drug.
3. The throat is made dry and red, the tonsils enlarged, and the morbid condition known as "smokers' sore throat" results.
4. The innervation of the heart is disturbed, its action being weak, irregular and intermittent; palpitation, precordial pains, faintness and vertigo are the consequence, forming the well recognized symptoms of "tobacco heart."
5. The laryngeal and bronchial mucus membranes, if already irritable, are made more so.
6. Owing chiefly to the disturbance in the blood and heart the processes of nutrition are slowed, and in the young may be seriously affected—tissue is degraded (Acton).
7. The sexual organs are at first stimulated, especially by cigarette smoking, but are eventually weakened in power; "excessive smokers, if very young, never acquire, and if older, rapidly lose their virile powers."—(Acton).
8. Vision is impaired, especially if alcohol is used in conjunc-

tion with the tobacco, "tobacco amblyopia" being produced. 9. Muscular coordination is impaired, especially in the young. Drawing-masters find that young smokers cannot draw a "clean, straightline." 10. The antidotal effects of alcohol to tobacco lead to forming the habit of drinking. 11. The powers of concentrating the mind, and perhaps of intellectual activity in general are lessened.

The Minister of Public Instruction of France, finding that smokers, as a rule, stood lower in their classes than non-smokers, has forbidden the use of tobacco in the public schools. "Alcohol oppresses the well nourished brain, though it soothes the exhausted one" (Richardson); in general, a person can do more intellectual work without tobacco than with it. All smokers can do more work if they smoke moderately, than if they smoke incessantly.

The above includes all that can be said against tobacco, and it is an indictment that is heavy enough. Indeed we cannot but feel a little of the conscious guilt that comes when ruthlessly proclaiming the frailties of a friend. It is in the cause both of justice and scientific truth, therefore, that we hasten to state some modifications of the very damaging charges given. Tobacco is essentially a functional rather than an organic poison. It modifies the special energies and not the structure. It does not, like alcohol, leave a knobby liver behind to proclaim past indiscretions at the autopsy. This is the strongest point to those who argue for its use. It is an evasive poison. Then again it is a drug that works its bad effects on a minority of those who use it, and these bad effects disappear very rapidly when the habit is given up. Tobacco is eliminated chiefly by the kidneys, and it leaves the system very rapidly; both acute and

chronic symptoms of tobacco-poisoning are, as a rule, in adults, quite transient. The effect of tobacco upon the throat is not very often injurious; Dr. Richardson's idea that it has a tendency to produce dyspepsia is opposed by the experience of many. Tobacco amblyopia is not at all common.

All this and still other things can be said in favor of the drug, but it is to be remembered that they apply almost entirely to tobacco as used by adults. The evils of tobacco are intensified a hundred fold upon the young. Here it is unqualifiedly and uniformly injurious; it stunts the growth, poisons the heart, weakens the sexual organs, impairs the mental powers and cripples the individual in every way. Not that it does all this to every youth, but it may be safely asserted that no boy of twelve or fourteen can begin the practice of smoking without becoming physically or mentally injured by the time he is twenty-one. We refer to this with especial emphasis because the practice among boys of smoking, and especially of smoking cigarettes, is now very prevalent. "The most prominent cause of rejection of candidates for apprenticeship in the navy," says Dr. Magruder, "is irritable heart, caused, in most cases, primarily by tobacco. Ten out of every thousand applicants in the year 1879 were rejected for "tobacco heart."

It is the duty of our public school instructors to make the facts in regard to tobacco known and impressively felt by their scholars, and we hope that this field of sanitary mission work will be actively occupied. Sewer gas is bad enough, but a boy had better learn his Latin over a man-trap than get the habit of smoking cigarettes. For we may lay it down as certain that tobacco is a bane to youth, though it may be the proper indulgence of manhood and a solace to old age.—*N. Y. Medical Record.*

## ENGLISH DEPARTMENT.

## GOLDSMITH.

**O**LIVER Goldsmith, the second son of the Rev. Chas. Goldsmith, was born 1728, at Pallas, in the parish of Forney, county of Longford, Ireland. A couple of years later the father removed with his family to a more lucrative position in the village of Lissoy, county of Westmeath. Goldsmith's father is pretty faithfully sketched in the Character of the Village Preacher. He is also regarded as the original of the "Man in Black," in the *Citizen of the World*.

Owing to the expense of educating the eldest son, the parents intended bringing up Oliver to some mercantile employment. He first received instructions from the school-master of Lissoy, Paddy Byrne—the original of the "Schoolmaster," in *The Deserted Village*. He early manifested an indolent disposition, but evidences of genius attracted the interest of his friends, some of whom resolved to furnish the means for giving him a University training.

In 1744 he was sent to Trinity College, Dublin, and after a very irregular, and by no means illustrious course, he received his B. A. in 1749.

His father died about this time, and his uncle, Rev. Wm. Contarine, became his patron. Hitherto he had distinguished himself more by his love of revelry and gambling than by any literary attainments. After vain attempts in theology, teaching and law, he left Ireland in 1752 and went to Edinburgh to study medicine. He remained there a year and a-half and then went to Germany, intending to finish his medical course at Leyden. Having squandered his means in gam-

bling, he was obliged to leave Leyden in a year. He then undertook the tour of Europe on foot. The trying experiences of this tour and the observations he made during it, are woven into several of his works, especially the *Vicar of Wakefield* and *The Traveller*. At Padua, in Italy, he is thought to have taken his medical degree.

In about 1756 his uncle's patronage was withdrawn and he was obliged thenceforth to supply himself with means by his own exertions. He returned from Italy to London, and there while suffering great want and enduring the severest hardships, he vainly endeavored to find profitable employment. He wrote for booksellers, contributed to magazines, and even for a time served as usher in a school. During the years thus passed in toil and obscurity, many of his best works were written. *The Traveller*, published in 1765, first established his reputation as an author, and from that time his works were universally read and were easily disposed of at a good price. Yet still his improvident habits kept him constantly in debt, and obliged him to make great exertions to meet demands upon him, and even to draw often in advance upon works that he was yet to write. Hence most of his works are prose hastily written to procure money, of which he stood much in need. His poetical works were written chiefly in leisure moments that he could spare from his essay or historical writing.

## THE DESERTED VILLAGE.

"This poem, after having been repeatedly announced and as often withdrawn for further revision, was at

last published on the 26th of May, 1770, when Goldsmith was in his 42nd year. The leading idea of it he had already thrown out in certain lines of *The Traveller*, and elsewhere in his works where we find that he had somehow become possessed of the idea that the accumulation of wealth in a country was the parent of all evils, including depopulation.

There is little doubt that Lissoy is the original of Auburn, and that the leading characters at least were drawn after those with whom Goldsmith had been familiar in his youth. Yet Macaulay affirms that there is no such hamlet as Auburn in Ireland, that *The Deserted Village* is a hopelessly incongruous poem, and that Goldsmith in combining a description of a probably Kentish village with a description of an Irish ejection has produced something which never has and never will be seen in any part of the world.

“But this criticism overlooks one of the radical facts of human nature—the magnifying delight of the human mind in what is long remembered and remote. Goldsmith had been since his youth, in a manner, an exile from his native land, and the Lissoy that he has in his mind is not a pure reality, but the home of his youth, Lissoy as his childish recollections recall it, freed from its rude and unpoetical realities, and with the features upon which his mind loved to dwell, magnified and clothed with a poetic beauty. The grown-up Goldsmith had not to go to any Kentish village for a model; the familiar scenes of his youth, regarded with all the wistfulness and longing of an exile, became glorified enough.

This poem has always retained its position in English literature, and has not been disturbed by any fluctuations in literary taste. We may give more attention at the moment to the new experiments of the poetic method, but we return only with renewed gratitude to the old familiar strain, not the least

merit of which is that it has nothing about it of foreign tricks or graces. In English literature there is nothing more thoroughly English than these writings produced by an Irishman, and whether or not it was Paddy Byrne and the Lissoy ale-house that Goldsmith had in his mind when he was writing the poem, is not of much consequence; the manner and language and feeling are all essentially English, so that we never think of calling Goldsmith anything but an English poet.”

#### HIS STYLE.

The most characteristic feature observable in all the works of Goldsmith, is the regularity with which he mirrors there his own life, disposition and experiences. *The Bee*, *The Citizen of the World*, his poems, his comedies, all present under one aspect or another his own life and sympathies, or even his follies and improvidence. There are few authors who can separate themselves from their work to such an extent that it is not possible to detect the hand of the artist behind the character that is sketched, but in few is the reflection of the artist so faithful and complete as here.

Another remarkable feature in Goldsmith is that while his works are universally esteemed, he displays the most defective knowledge of details in everything. His natural indolence unfitted him for mastering any subject thoroughly, so that in his works in science and history he falls into the most absurd errors. But so great is his faculty for generalization and so delicate his power of description that the defect of exactness is scarcely noticeable, so little does the merit of his work depend upon that quality. The details of his plots, too, are always full of improbabilities, and are strangely in contrast with the rigid exactness of the artificial School of Pope. Yet, strange to say, a story

marked with all these defects and improbabilities, moves all classes of readers with a power unknown to the works of Pope. The brilliancy of his imagination, the sympathy that we are made to feel for his characters, and the life-like reality of these characters, these are the features that charm and delight us, and it is these that remain in our memory when improbabilities and other defects are forgotten. Goldsmith's characters speak and act with a natural ease and grace and simplicity that make them live in our imagination, and we easily persuade ourselves that we are reading a description of some reality, and not the mere work of the poet's fancy. It is for

these real poetic qualities that Goldsmith is justly regarded as the harbinger of the school of natural poetry that in later years sprang into existence. Notwithstanding all his faults he will never cease to be read and admired, and the skill and delicacy with which he sketches his characters, the natural simplicity and exquisite melody, the delicacy of figure and imagination displayed in *The Traveller* and *The Deserted Village*, these qualities will ever make him dear to all lovers of English literature, and entitle him to a place in the foremost rank of our authors and poets.

## QUESTIONS ON ENGLISH LITERATURE.

*For University Pass Junior Matriculation and Intermediate.*

### GOLDSMITH'S DESERTED VILLAGE.

1. Distinguish between prose and poetry, as to—

(a) Form.

(b) Subjects treated of; and distinguish between pure and mixed poetry.

(c) Object aimed at; and how this affects the style of each.

2. Give the chief divisions of poetry, and explain the nature of each.

3. Show how far idealistic or realistic effects enter into "The Deserted Village." Explain the meaning of the terms Idealism and Realism.

4. Does "The Deserted Village" come under the head of pure or mixed poetry?

5. (a) Sketch the life of Goldsmith.

(b) Show how an acquaintance with an author's life may sometimes assist us in the fuller comprehension and appreciation of his work.

6. Characterize the great schools of English Literature, and account for their development and decay.

7. State Goldsmith's position with reference to the schools of English Literature.

8. Estimate the effect his works have had upon his contemporaries and upon posterity.

9. Who were his chief literary contemporaries?

10. Account for change of poetic subject, or show how the poor came to be regarded as proper subjects of poetic interest.

11. Explain the effect which the change from the patronage of the court and nobility to that of the public has had upon literature.

12. Name the members of the Literary Club to which Goldsmith

belonged, and give a brief account of each.

13. Account for the rise of Clubs in the era of Goldsmith, and for their subsequent decline.

14. Which of the elements that afterwards brought about the rise of the Romantic school is to be noted in Goldsmith's verse?

15. Give the history of the heroic metre. Investigate its suitability for such a poem as "The Deserted Village."

16. (a) What deviations from the strictly Iambic character of the heroic line are permissible, and where?

(b) Is there any other way to vary the rhythm of the line?

17. What are the faults of rhyme?

18. (a) How did rhyme come to be introduced into poetry? Give arguments in favor of or against its use.

19. State the laws of melody; show how these have been observed by Goldsmith.

20. What is Imitative Harmony? Show how words may imitate sounds

and motions. Give examples from "The Deserted Village."

21. Show how Goldsmith has observed the rules of poetic description in his depictions of the Village.

22. Refer to the incongruity in the description of the Village in prosperity and adversity.

23. How was this incongruity accounted for by Macaulay?

How have Macaulay's strictures been answered?

24. Contrast Goldsmith's love of nature with Wordsworth's.

25. Show how Goldsmith's method of describing nature differs from Wordsworth's, as indicated by the latter in the passage:

—"Add the gleam,

The light that never was on land or sea,  
The consecration, and the poet's dream."

26. What is the chief error in the treatment of the subject in "The Deserted Village"?

27. Criticize the author's views of political economy.

28. What is the theme of "The Deserted Village"?

## MATHEMATICAL DEPARTMENT.

UNIVERSITY OF TORONTO.

Pass Mathematics.—June, 1881.

1. Simplify

$$\frac{.8}{.3} - \frac{45}{8} \left( \frac{16}{25} - 1 \right) + \frac{\frac{4}{3} \left( 64 - \frac{1}{3} \right) \times .390625}{.11 \left( \frac{1}{3} + \frac{1}{2} \right)}$$

2. Find the square root of 5 to five decimal places, and deduce the value of

$$\frac{1}{\sqrt{5}}, \sqrt{.002}, \frac{5 + \sqrt{5}}{5 - \sqrt{5}}, \text{ and } \sqrt{6 + 2\sqrt{5}}.$$

3. (a) How much will \$1,000 amount to in  $2\frac{1}{2}$  years, compound interest, 4 per cent. per annum, payable half-yearly?

(b) A person pays \$292.50 for \$300 due three months hence. What rate per cent. interest does he receive?

4. What is meant by the expression "Sterling Exchange,  $9\frac{1}{2}$  p. c. premium"?

A person pays \$181.50 for £37, 10s., stg. What per cent. premium is Sterling Exchange?

5. Multiply  $b^2 + (a-b)(b-c)$  by  $c^2 + (b-c)(c-a)$ .

Show that your answer is correct by substituting  $a = 2$ ,  $b = 0$ ,  $c = -3$ .

6. Simplify (1)  $\frac{a^2 b c^{-2}}{a^{-1} b^3 c^{-3}}$   
 (2)  $\frac{x^2 - 2 + x^{-2}}{x^2 - x^{-2}} - \frac{x^2}{x^2 + 1}$

7. Resolve into factors  
 $a^2 - b^2, ab + bc + ca + b^2$   
 $a(b+c)^2 + b(c+a)^2 + c(a+b)^2 - 4abc.$   
 $(a+b)^3 - 2b \frac{a^3 - b^3}{a - b} + c(a^2 - b^2) - 2ab^2.$

Find the Greatest Common Measure and the Least Common Multiple of these four quantities.

8. Solve the equations

(1)  $ax + b = bx + a.$

(2)  $\frac{1}{x^2 + 3x + 2} + \frac{1}{x^2 + 5x + 6} = \frac{1}{x^2 + x - 2}$

(3)  $\begin{cases} \frac{2}{x} - \frac{3}{y} = 4. \\ 2x - 3y = 2xy. \end{cases}$

(4)  $\begin{cases} xy - yz = 18. \\ x^2 + z^2 = 4y^2 + 2xz. \\ x^2 - 8 = 2xy + 2xz. \end{cases}$

9. There are two vessels, *A* and *B*, each containing a mixture of water and wine. *A* in the ratio of 2 : 3, *B* in the ratio of 3 : 7. What quantity must be taken from each in order to form a third mixture which shall contain 5 gallons of water and 11 of wine?

10. Describe a triangle, of which the sides shall be equal to three given straight lines, any two of which are together greater than the third.

A straight line *AD* is divided into three equal parts by the points *B* and *C*; on *AB*, *BC*, *CD* are described equilateral triangles *AEB*, *BFC*, *CGD* respectively; show that the three straight lines *AE*, *AF*, *AG* can form a triangle equal in area to the equilateral triangle *AEB*.

11. Divide a given straight line into two parts, so that the rectangle contained by the whole and one of the parts shall be equal to the square on the other part.

12. Define the terms *circle*, *tangent to a circle*, and *segment of a circle*.

The angles in the same segment of a circle are equal to one another.

SOLUTIONS.

2.  $\sqrt{5} = 2.23606,$

$\therefore \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5} = \frac{2\sqrt{5}}{10} = .447212.$

$\sqrt{.002} = \sqrt{\frac{1}{500}} = \frac{1}{10\sqrt{5}}$

$= \frac{1}{10}$  of  $\frac{1}{\sqrt{5}} = .0447212.$

$\frac{5 + \sqrt{5}}{5 - \sqrt{5}} = \frac{(5 + \sqrt{5})(5 + \sqrt{5})}{(5 - \sqrt{5})(5 + \sqrt{5})}$

$= \frac{5 - \sqrt{5}}{30 + 2\sqrt{5}} = \frac{15 + \sqrt{5}}{10}$

$= \frac{20}{10} = 2$

$= 1.723606.$

$\sqrt{6 + 2\sqrt{5}} = 1 + \sqrt{5}.$

4. "Sterling Exchange, 9½ per cent. premium" means that

4s. : 6d., stg. \$1.09½.

If £37 : 10s. = \$181.50

$\therefore 4s. : 6d. = \$1.089$

$\therefore 8\frac{9}{10}$  is required result.

7.  $a(b+c)^2 + \&c.,$  reduces to  
 $ab^2 + bc^2 + ca^2 + a^2b + b^2c + c^2a + 2abc$   
 $= (a+b)(b+c)(c+a).$

The third expression

$= (a+b)(a-b)(a+b+c).$

8. (4)  $y(x-z) = 18,$  from (1)

$(x-z)^2 = 4y^2$  " (2)

$x^2 - 2x(y+z) = 8$  " (3)

$\therefore x-z = 2y$  or  $-2y$

$\therefore 2y^2 = 18$  or  $-18$

$\therefore y = 3, -3, 3\sqrt{-1}$  or  $-3\sqrt{-1}$

$\therefore x-z = 6, -6, \&c.$

whence we have *z* in terms of *x*.

Now substitute for *y* and *z* in (3), and we have a quadratic in *x*.

9. Let 10*x* be the number of gallons that must be taken from *A*, and 10*y* the number from *B*; then the first of these will contain 4*x* gallons of wine and 6*x* of water, while the



second will contain  $3y$  of wine and  $7y$  of water; therefore altogether there will be  $4x+3y$  of wine and  $6x+7y$  of water,

$$\therefore \frac{4x+3y}{6x+7y} = \frac{5}{11}$$

$$\therefore 14x = 2y$$

$$\therefore 7x = y,$$

That is, the mixture must be formed by taking 7 gallons from  $B$  for every gallon taken from  $A$ .

10. Join  $FG$ , then the triangle  $AGC$  is evidently equal to  $ABE$ .

ALGEBRA.—HONORS.

1. Find the relation among the co-efficients of  $ax^2+2hxy+by^2+2gx+2fy+c$  in order that it may break up into two linear factors with real co-efficients.

2. Solve

$$(1) \quad 64x^3 + 27y^3 = 8216$$

$$x + y = 10$$

$$(2) \quad 16x^4 - 81y^4 = 3090960$$

$$2x + 3y = 54$$

$$(3) \quad x + yz = y + zx = z + xy = 1.$$

3. From

$$\left. \begin{aligned} x^2 + x_1^2 + x_2^2 &= mb^2 \\ y^2 + y_1^2 + y_2^2 &= ma^2 \\ xy + x_1y_1 + x_2y_2 &= 0 \\ x + x_1 + x_2 &= 0 \\ y + y_1 + y_2 &= 0 \end{aligned} \right\} \begin{array}{l} \text{eliminate } x_1, y_1, \\ x_2, y_2. \end{array}$$

4. If  $A$  varies as  $B$  when  $C$  is invariable, and  $A$  varies as  $C$  when  $B$  is invariable, then  $A$  varies as  $BC$  when both  $B$  and  $C$  are variable.

It  $t$  be the time of a complete vibration of a pendulum of length  $l$ ,  $t \propto \sqrt{l}$ . Hence find the length of a two-second pendulum when the length of the second pendulum is 39.4 inches.

5. Find the limit of an infinite geometrical progression whose common ratio is less than unity.

The first term of an infinite G. P. is 1, and any term is equal to the sum of all the succeeding terms. Find the common ratio.

Sum to  $3n$  terms the series

$$1 + 4 + 27 + 4 + 25 + 216 + 7 + \text{etc.}$$

6. Find the number of permutations of  $n$  things taken  $r$  together.

Three boxes contain respectively 4, 5, and 6 counters. In how many ways may 4 counters be drawn, not taking more than 2 from one box?

If  $P_r$  be number of permutations of  $n$  things taken  $r$  together, show that when  $m > 2$

$$(P_1 - 1)(P_2 - P_1) \dots (P_m - P_{m-1}) = P_2 P_3 \dots P_{m-1} P_{m+1}.$$

7. Prove the binomial theorem for all values of the index.

(1) The remainder after  $n$  terms of the expansion of

$$(1-x)^{-2} = \frac{(n+1)x^n - nx^{n+1}}{(1-x)^2}$$

$$(2) \quad \sqrt{2} = 1 + \frac{3}{2} \lfloor 2 - \frac{3 \cdot 5}{2^2} \lfloor 3 + \frac{3 \cdot 5 \cdot 7}{2^3} \lfloor 4 - \dots$$

EUCLID.—HONORS.

1. If a point be taken within a circle, from which there fall more than two equal lines to the circumference, that point is the centre of the circle.

2. If a straight line touch a circle, the straight line drawn from the centre to the point of contact shall be perpendicular to the line touching the circle.

3. About a given circle describe a triangle equiangular to a given triangle.

4. Inscribe an equilateral and equiangular hexagon in a given circle.

5. Define ratio, compound ratio, and proportion. How is the equality of two ratios ascertained?

6. If the segments of the base of a triangle have the same ratio which the other sides have, the straight line drawn from the vertex to the point of section divides the vertical angle in two equal angles.

7. Find a fourth proportional to three given straight lines.

8. Rectilinear figures which are similar to the same rectilinear figure are also similar to one another.

9. From a vessel two known points are seen under a given angle; the vessel sails a given distance in a given direction, and the same two points are seen under another given angle. Find the position of the vessel.

10. About a given circle describe a triangle, the angular points of which lie on three given straight lines drawn from the centre of the circle.

11. The locus of the vertices of triangles on a given base, having their sides in a given ratio, is a circle.

TRIGONOMETRY.—HONORS.

1. Define a logarithm. Of what two parts is a logarithm composed? Show that in the common system, one of these parts may be determined by inspection,

$$\text{Prove that } \log x^{\frac{m}{n}} = \frac{m}{n} \log x.$$

$$\log_b x = \frac{\log_a x}{\log_a b}.$$

2. Write down the characteristics of the common logarithms of 0.2, 0.00005, and 5555.5.

3. Find the logarithms of

$$\frac{\sqrt{3} \cdot \sqrt[3]{282.9}}{7 \cdot \sqrt{7.2798}}, \frac{\sqrt{.003}}{2 \sqrt[3]{.05}}, \sin 60^\circ, \cot 45^\circ, \operatorname{cosec} 30^\circ.$$

Find  $x$  from the equation  $(1.08)^x = 2$ .

4. Define the following trigonometrical ratios of any angle, viz: the sine, the cosine, the tangent and the secant; and explain the origin of the names.

Prove that the sine of a given angle can have only one value. Is the converse true?

Write down the value of  $\cos 0^\circ$ ,  $\sin 45^\circ$ ,  $\tan 30^\circ$ .

5. Having given  $L \cos 37^\circ 14' = 9.9010102$ ,

and difference for  $1' = 960$ , find  $\cos 37^\circ 14' 16''$ , and  $L \operatorname{cosec} 52^\circ 45' 54''$ .

6. Prove the formulæ

(1)  $\sin(A - B) = \sin A \cos B - \cos A \sin B.$

(2)  $\cos^2 A = 1 - 2 \sin^2 A.$

(3)  $\frac{\sin A + \sin B}{\sin A - \sin B} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$

(4)  $\frac{\sin A + \sin 2A}{1 + \cos A + \cos 2A} = \tan A.$

7. How many parts of a triangle must be given to effect its solution?

In a certain triangle  $ABC$  it is known that  $\sin^2 A = \sin^2 B + \sin^2 C$ . Show that one of the angles may be found, and find it.

8. In any triangle prove that

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

(2)  $\tan \frac{A-B}{2} = \frac{a-b}{a+b} \cot \frac{C}{2}.$

(3)  $\sin B \operatorname{cosec} A = \frac{\cot \frac{A}{2} + \cot \frac{C}{2}}{\cot \frac{B}{2} + \cot \frac{C}{2}}.$

9. Solve the triangles

(1)  $A = 143^\circ 23'$ ,  $a = 60$  ft.,  $b = 54$  ft.  
 (2)  $A = 64^\circ 56'$ ,  $b = 311.5$  ft.,  $c = 111.5$  ft.

10. Having given the three sides of a triangle, find the radii of the inscribed and circumscribed circles.

Number:	Log.	Angle.	Log.
11150	.04727	$4^\circ 9'$	$L \sin 8.85955$
20000	.30103	$20^\circ 55'$	$L \sin 9.55268$
28290	.45163	$32^\circ 28'$	$L \sin 9.72982$
30000	.47712	" "	$L \tan 9.80363$
42300	.62634	$36^\circ 37'$	$L \sin 9.77558$
70000	.84510	" "	$L \tan 9.87106$
72798	.86212	$64^\circ 56'$	$L \sin 9.95704$

PROBLEMS.—HONORS.

1. If a straight line terminated by the sides

of a triangle be bisected, no other line terminated by the same two sides can be bisected in the same point.

2. If two equal circles be described cutting each other in  $A$  and  $B$ , and from  $A$  a chord be drawn cutting them in  $C$  and  $D$ , prove that the part  $CD$  between the circumferences will be bisected by the circle described on  $AB$  as diameter.

3. Circles are described on two of the sides of a triangle as diameters, and each meets the perpendicular from the opposite angular point on its diameter in two points; prove that these four points lie on a circle whose centre is at the intersection of the two sides.

4. Prove that

$$\frac{a^2 \left( \frac{1}{b} - \frac{1}{c} \right) + b^2 \left( \frac{1}{c} - \frac{1}{a} \right) + c^2 \left( \frac{1}{a} - \frac{1}{b} \right)}{a \left( \frac{1}{b} - \frac{1}{c} \right) + b \left( \frac{1}{c} - \frac{1}{a} \right) + c \left( \frac{1}{a} - \frac{1}{b} \right)} = a + b + c.$$

5. If  $x + y + z = xyz$  prove that

$$\left( \frac{x}{y} + \frac{y}{x} + \frac{y}{z} + \frac{z}{y} + \frac{z}{x} + \frac{x}{z} + 2 \right)^2 = (1+x^2)(1+y^2)(1+z^2).$$

6. Solve the equations

$$\begin{aligned} x + y + z &= 2(a + b + c). \\ ax + by + cz &= 2(ab + bc + ca) \\ (b-c)x + (c-a)y + (a-b)z &= 0. \end{aligned}$$

7. A waterman rows a given distance  $a$  and back again in  $b$  hours, and finds that he can row  $c$  miles with the stream in the same time as  $d$  miles against it. Find the time

each way, and the rate of the stream.

8.  $ABC$  is an isosceles triangle,  $D$  the middle point of the base  $BC$ . If any straight line drawn through  $D$  meets one side in  $E$  and the other produced in  $F$ , then  $AE, AC, AF$  are in harmonic progression.

9. Given

$$\tan^2 x + \sec 2x = \frac{7\sqrt{3} - 10}{\sqrt{3}} \text{ find } x.$$

10. If  $A, B, C$  be the angles which the sides of a triangle subtend at the centre of the inscribed circle, prove

$$4 \sin A \sin B \sin C = \sin A + \sin B + \sin C$$

11. If  $\cos^2 \theta = \frac{\cos a}{\cos \beta}$ ,  $\cos^2 \theta'$

$$= \frac{\cos a'}{\cos \beta'} \text{ and } \frac{\tan \theta}{\tan \theta'} = \frac{\tan a}{\tan a'}$$

prove that  $\tan \frac{B}{2} = \tan \frac{a}{2} \tan \frac{a'}{2}$ .

12. If  $\cos c = \tan m \cot a$ ,

$$\cos p = \tan m \cot b,$$

$$\sec c \sec p =$$

$$\sec m \tan c \tan p - \tan a \tan b;$$

show that  $\cos^2 m = \cos^2 a \cos^2 b$ .

13. Four points, moving each at a uniform speed, take 198, 495, 891, 1155 seconds respectively to describe the length of a given straight line. Supposing them to be together at any instant at the same end of the line, and to move in it from end to end continually, what interval of time will elapse before they are together at the same point again?

## SCIENCE DEPARTMENT.

MATRICULATION EXAMINATION, LONDON UNIVERSITY, JANUARY, 1873.

*(Answered by M. Dippel.)*

1. "One pound of boiling water at  $100^{\circ}\text{C}$  is placed in contact with one pound of Mercury at  $0^{\circ}\text{C}$ . Heat is transmitted from the water to the Mercury until both are at the same temperature. Calculate this temperature in degrees of the centigrade scale. [Specific heat of Mercury =  $0.033$ .]"

Let  $t$  = required temperature. The specific heat of water being taken as 1,  $100 - t$  (the quantity of heat lost by the water) must equal  $t \times 0.003$  (the quantity of heat received by the Mercury.)

$$100 - t = t \times 0.003$$

$$100 = 1.033t$$

$$\therefore t = \frac{100}{1.033}$$

$t = 96.8^{\circ}\text{C}$ , the temperature of the water and Mercury,

2. "The Ancients used to consider air as one of the elements. Describe properties of air which cause it no longer to be regarded as an element."

The following experiments prove that air is not an element but a mechanical mixture of Oxygen and Nitrogen :

(a) By burning Phosphorus in a portion of air confined in a bell jar standing over water, two important facts are elicited: (1) That only one-fifth of the air in the bell jar takes part in the combustion of the Phosphorus. (2) That the other four-fifths neither burn nor support combustion. This experiment is very similar to the original one performed by Lavoisier. Lavoisier kept Mercury at a temperature near its boiling point for many days in contact with a known volume of air, and found that red scales formed on the surface of the Mercury, THAT ONE-FIFTH OF THE AIR DISAPPEARED, AND THE REMAINING, FOUR-FIFTHS WERE INCAPABLE OF SUPPORTING

COMBUSTION. He then heated the red scales to a higher temperature than that at which they were formed, and found that they decomposed into Mercury and a colorless gas which supported combustion more powerfully than air, and which, when added to the portion of the air left in the first part of the experiment, restored all its original properties.

(b) The volumetric composition of air may be ascertained by introducing into a eudiometer, previously filled with Mercury, a certain volume of air (say 100 volumes) and sufficient Hydrogen to combine with all the Oxygen present (say 50 volumes). An electric spark is now passed through the mixture. Two volumes of Hydrogen will unite with one volume of Oxygen to form water, and from the diminution of volume resulting, the quantity of Oxygen in the air taken may be calculated,

100 volumes of air.

50 " Hydrogen,

150 " before the electric spark.

87 " remain after electric spark.

$\therefore 63$  " have disappeared.

$63 \div 3 = 21$  volumes of Oxygen in 100 volumes of air.

(c) To determine the composition of air by weight, the apparatus of Dumas and Boussingault are employed. (a) A large glass globe furnished with a stopcock is exhausted and weighed. (b) A hard glass tube furnished with stopcocks and containing copper turnings is also exhausted and weighed. (c) The tube is connected at one end with the glass globe, at the other with a series of U tubes containing pumice stone soaked with Sulphuric acid and lumps of solid potash. The tube is now raised to a red heat and the stopcocks of the exhausted globe and of the

tube are slightly opened. Air at once passes through the U tubes, which absorb Carbonic acid and water, then over the metallic copper which combines with all the Oxygen forming copper oxide—Nitrogen alone entering the globe. The increase in weight of the globe and tube added together will give the whole quantity of pure air that has entered the apparatus, and the individual increase of globe and of tube, the proportion in which the Oxygen and Nitrogen existed in that quantity. The other constituents of the air are Carbonic acid, water (aqueous vapor), and Ammonia and Nitric acid in very small quantities. The presence of Carbonic acid,  $\text{CO}_2$ , is detected by exposing lime-water  $\text{Ca}(\text{OH})_2$ , to the air. The Carbonic acid of the air combines with the lime-water to form insoluble Calcium Carbonate,  $\text{CaCO}_3$ , and so turns the liquid milky. The presence of water,  $\text{H}_2\text{O}$ , may be shown by (a) exposing fragments of Calcium Chloride,  $\text{CaCl}_2$ , to the air. They become liquid through the absorption of moisture from the air. (b) A glass filled with a frigorific mixture of powdered ice and salt, if left in air, soon becomes covered with hoar frost (congealed water) deposited from the air.

The air is a mechanical mixture.

1. When Nitrogen and Oxygen are brought together in the proportion in which they are found in the air, no alteration in bulk or temperature occurs; hence no chemical union can have taken place, and yet the mixture has all the properties of air.

(2). When air is shaken up with water some of the air dissolves; this air may be expelled by boiling. It is found to consist of Oxygen and Nitrogen in the proportion of 1 to 1.87. Had it been a compound it would have dissolved in the water without change of proportional composition, that is, one volume of Oxygen to four volumes of Nitrogen.

3. "How would you show that water is formed when Hydrogen is permitted to burn in air? How would you extract Oxygen from water? Explain your process."

(a) If a dry tumbler be held over the Hy-

drogen flame, drops of water soon collect on its sides.

(b) Fill a dry jar with dry Hydrogen by upward displacement, and then light the Hydrogen at the mouth of the jar. The sides will become dim, owing to the formation of water.

(c) Allow a flame of Hydrogen to burn under a funnel bent at right angles and connected with a dry, cool receiver. Water in the form of steam will pass into the receiver and be condensed.

Oxygen is extracted from water by electrolysis. Into a vessel fitted with two water-tight corks, through each of which a short stout wire (platinum or copper) passes, having two slips of platinum foil attached to their ends inside, a quantity of water acidulated with Sulphuric acid is poured. The water should cover the platinum foils. The ends of the wires outside are now connected with the terminals of a galvanic battery. Oxygen will collect at the positive pole.

4. "Describe and explain the preparation of Ammonia gas from Ammonia Chloride and slaked lime. The molecule of Ammonia consisting of one atom of Nitrogen and three atoms of Hydrogen, what is the density of Ammonia on the Hydrogen scale? What happens when one volume of Ammonia gas and three volumes of Hydrochloric acid gas (Hydric Chloride) are mixed together?"

(1). Into a flask fitted with cork and delivery tube introduce coarsely powdered Ammoniac Chloride,  $\text{NH}_4\text{Cl}$ , together with its own weight of slaked lime and enough water to make the whole into a thick paste. Attach to the delivery tube a cold, empty washing bottle and a U tube containing lumps of solid potash. Apply heat; Ammonia in the form of a colorless gas will be given off and may be collected by downward displacement or over mercury. The cold, empty washing bottle and the lumps of solid potash catch the moisture that comes over, rendering the gas perfectly dry.

(2). The density of Hydrogen being taken

as standard, that of Nitrogen is 14. In the molecule of Ammonia there are three atoms of Hydrogen weighing 3, and one atom of Nitrogen weighing 14; its molecular weight must accordingly be 17. But the molecule occupies two volumes, therefore the density of Ammonia, as compared with the standard, Hydrogen, must be  $17 \div 2 = 8.5$ .

(3). When one volume of Ammonia and three of Hydric Chloride are mixed, one volume of the Hydric Chloride unites with one volume of the Ammonia to form Ammonic Chloride,  $\text{NH}_4\text{Cl}$ ; the other two volumes of Hydric Chloride will remain unchanged.

5. "What substance is formed when a piece of dry phosphorus is burnt in an excess of dry air? Give the formula of the phosphorus compound produced, and explain how it is acted upon by boiling water."

Phosphorus Pentoxide  $\text{P}_2\text{O}_5$  is formed when dry phosphorus is burnt in excess of dry air. This Phosphorus Pentoxide in contact with boiling water forms Orthophosphoric acid;  $\text{H}_3\text{PO}_4$ .  $\text{P}_2\text{O}_5 + 3\text{H}_2\text{O} = 2\text{H}_3\text{PO}_4$ .

6. Two bottles, one containing Carbonic Oxide and the other Anhydrous Carbonic acid are given you to determine the nature of the gases in each bottle. Describe the experiments you would perform for this purpose. By what process is Carbonic acid gas generated in nature?"

(1) The two gases are easily distinguished by means of a lighted taper.

Carbonic acid neither burns nor support combustion.

Carbonic Oxide burns with a very bright blue flame.

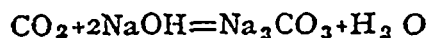
(2) Water at the ordinary temperature and pressure dissolves its own volume of Carbonic acid. Carbonic Oxide is insoluble in water.

(3) Carbonic acid is readily condensible to a liquid. Carbonic Oxide until recently was considered non-condensable.

(4) Carbonic Acid has no reducing properties. Carbonic Oxide is a powerful reducing agent as may be shown by passing it over ignited Oxide of lead.

(5) If Carbonic acid be passed through lime water,  $\text{Ca}(\text{OH})_2$  the liquid will be rendered troubled owing to the formation of insoluble Calcium Carbonate,  $\text{CaCO}_3$ . Carbonic Oxide produces no effect upon lime water.

(6) If Carbonic acid be passed into solution of Sodium Hydroxide,  $\text{NaOH}$ , it is readily absorbed, Sodium Carbonate,  $\text{Na}_2\text{CO}_3$  being formed:



Carbonic Oxide must be heated for a long time in contact with moist  $\text{KOH}$  before it is absorbed, Potassic Formate,  $\text{CHKO}_2$ , being formed,  $\text{CO} + \text{KOH} = \text{CHKO}_2$ .

Carbonic acid gas is given off in the processes of fermentation, respiration, combustion, decay, putrefaction and germination.

## WHAT SHALL WE TEACH?

A. J. RICKOFF.

IF teachers were to look beyond the traditional demands of the market for which we are training the little children under our care, and were to analyze minutely and conscientiously the knowledge and discipline of the best classes of grown-up men and women, the moral and mental habits, if you please, of well-informed

and intelligent people of different vocations in life; and if we were then to address ourselves not to the supply of a market, the demands of which are determined by the ignorant masses rather than intelligence, but to meet the real needs of a people, there can be little doubt that the curriculum of our common schools would be cast

aside as of little value, or as absolutely worthless, and its place would be supplied by elements which now scarcely appear on the programme.

But let me be more specific. If the schoolmaster, or rather the true educator of the race, were to send a commission to its workshops, its farms, its churches, its political and religious conventions, its teachers' desks, and its editorial rooms, to make diligent enquiry of the men and women to be found there, as to how much of the knowledge acquired in the elementary schools in common to a majority of them—I mean a majority of the most intelligent—the very leaders in each class; and if this commission were to make careful observation of every remaining trace of the intellectual and moral discipline of the schools to be found in the modes of reasoning and styles of expression used by those whom they met in the course of their inquiries; and if, when this investigation had been completed, the commission were to set itself about the elimination of everything in the present course of common school instruction, which had been found to have been rejected as of least worth by a great majority of the most intelligent workmen, tradesmen, and members of the learned professions, how much do you think would remain of all that is so laboriously taught and so painfully learned in the schools?

Suppose that when room had been made in our course of study, by throwing out that which had been found to be comparatively valueless, this commission should substitute therefor more ample courses of instruction in those subjects, which, in the progress of their inquiries, they had found to have been studied at school, and to have been extended by the great majority beyond school-life into the self-directive years of manhood and womanhood; and further, if the commission were to add

to this curriculum the study of the agencies through which town, county, state, and national governments act, the mere machinery of the administration, and a few of the more palpable and important principles of political economy; and still further, if it were to add an introduction at least to the great English and American authors, whom to know well is itself an education, and whom it is a disgrace not to know, whose productions are the richest inheritance of our race; or to sum up in more general terms, if we were to subject the common course of instruction in our common district and graded schools to a thorough revision, rigorously excluding all that is consciously and unconsciously neglected as valueless by intelligent men and women, as soon as they become free to judge and act for themselves, and substituting those things to which every young man and young woman who is ambitious to become a worthy factor in the affairs of the community, the State, or the Nation, is forced to give earnest attention to as he emerges from the school; if, in a word, we were to "prove all things and hold fast only that which is good," we would perform the highest service to the cause of common school education which it is possible for any association to perform.

What, for instance, would be the result of an enquiry among the more intelligent tradesmen and members of the professions as to the knowledge of geography which they have retained or accumulated, we will say, at from thirty-five to fifty years. I do not speak of that alone which they learn in childhood, but of the sum total of all the knowledge they may claim at the time of the inquiry. I think it would be found that they know very little as compared with the fourteen or fifteen years old miss who has just passed her examination for the high school in any one of our towns or cities, except

as to those points which they have in later years looked up for purposes of business or pleasure. Not having any relation to the course of reading or business pursuits of matured years, the names and locations of rivers, mountains, lakes, cities, capes, nations, etc., drop from the memory of most men as the features of people who pass us in rapid-moving procession. The studying having served its purpose in the recitation-room and examination day, is promptly dismissed from the mind. Test the value of a study thus pursued by any standard you please, and it is valueless except as to its general outlines, which can be learned in one-third the time now allotted to it. As studied it contributes little to our stores of useful information and still less to the discipline of mind, inasmuch as it begets a habit of careless indifference to what we have learned.

There is only one possible good which the study of such a multiplicity of details can serve. The persistent effort to store them in memory, even for temporary use, puts the faculty of attention under the control of the will. But if that is the only advantage we expect to obtain from it, the names and the infinitely varying characteristics of the objects which are all about us in the natural world and in the world of art and industry, would serve the purpose still better.

Take English grammar. Its utility in training us to speak the language with correctness and precision is claimed by very few of those who advocate its retention in all its magnificent proportions in the curriculum of the elementary schools. Its claims rest mainly on its assumed value as a disciplinary study; but I am willing to concede little in its favor which I would not concede to geography. As to the training of judgment and reason, which is claimed as the chief excellence, I must say that I have no very high respect for it. Taught at an age

when the power of abstract reason is yet very feeble, the supposed exercise of reason is likely to be only an exertion of the verbal memory. At this period of life the interest which may seem to be excited in this study is only a fear of reproof or a laudable ambition to stand well in class. That it is beyond the capacity of children in our elementary schools, is now allowed by most authorities on the subject. If their conclusions be true, the deduction is inevitable that the study is not only useless but pernicious—pernicious not alone because it displaces other studies which would be of far greater practical utility, but because of the mistaken notion of the true nature of a process of reasoning which it begets in the mind of the average child. Premises being given, and a conclusion derived by a false process, or by a process which is not understood, the integrity of the reason is violated and confidence in its operations impaired, and the faculty itself permanently weakened instead of being strengthened. I have no hesitation, therefore, in rejecting grammar or the greater part of it from the list of common-school studies.

But what of arithmetic? I answer with some reluctance, because I know how strongly fortified this subject is in the minds of the people. For illustration, I might say that an amendment of the Catechism has been proposed by a gentleman in the part of the State of Ohio from which I came. In answer to the question, "What is the chief end of man?" he would reply, "To glorify God and study Arithmetic forever." Within a few years past, say the last thirty or forty, far more attention has been given than it deserves. We do not teach it too well, not well enough, as to its elements, but we attempt to teach too much of it. We teach more in the schools than is necessary in the counting room. I am told by the gentleman above referred



to that, having occasion to draw a note which would realize a certain sum when discounted at the bank, he found the cashier unable to reckon the amount for which it should be drawn. This suggested a series of inquiries among bankers, which resulted in the discovery that hardly one out of ten could make the calculation on sight.

Again, I am told by insurance men that they are never called upon to effect an insurance covering both the value of the property and the sum paid for insurance, and that in consequence the computation is never necessary. Here are two famous "gags" of boards of examiners with which you are all familiar. They require a knowledge of arithmetic beyond what is required in the very lines of business to which they are supposed to pertain, yet they are treated of in every school text-book on this subject.

The truth is that in arithmetic we ought to attempt to teach only that which is common to all trades and professions, certainly no more than is common to a majority of them. What is peculiar to the banker, the insurance agent, county auditor, the collector of customs, the exchange broker should be taught as belonging to a trade or profession to be learned only when it becomes necessary in learning the trade. It may be said that the customer at bank needs to know how to discount a note as well as the cashier; but to this I reply that with a little common sense, if he knows how to cast interest, he can detect the error of the bank clerk, though it may take him some time to acquire the facility in doing it which the clerk needs.

If a boy is skilled in addition, subtraction, multiplication and division—integral, fractional and compound—and knows how to compute percentage and one good way of casting interest, he can take care of himself in the commercial dealings to which his business

incidentally calls him, and with that he can easily acquire facility in those computations which belong specially to his own branch of trade.

So far as common problems in mensuration are concerned, I would have them provided for in a simple course in geometry, which I would have substituted for the many commercial rules now required. If the question were directly under consideration, I think it might be maintained with success that the measurements of surfaces and solids is of a far more general utility than the reckoning of annual or compound interest or bank discount or partial payments, and certainly, to say the least, they are quite as simple. I would say study, master these applications at any cost, if they were essential to the elements of arithmetic, but they are not. As a matter of fact, I think it will be almost universally confessed that these special applications are taught at the expense of an understanding of the elements, at the expense even of readiness and accuracy in straight addition, subtraction, multiplication and division of simple numbers.

If the claims of competing studies had been duly weighed, and the work now required had been fixed by a competent commission of intelligent men, in the light of circumstances as they exist to-day, I would be slow to question the wisdom of their decision; but it is a notorious fact that the multiplicity of rules and cases to be found in our text books on this subject is due to the efforts of one author after another to make his books more complete than the previous publications with which they are to come in competition; and being in the arithmetic, the teacher, especially in our ungraded schools, feels under obligation to teach them all, lest perchance it might be charged that he himself could not do all the "sums" in the book.—*Educational Journal of Virginia.*

## PUBLIC SCHOOL DEPARTMENT.

MCGILL UNIVERSITY SCHOOL EXAMINATIONS, 1881.

*Preliminary Subjects.*

## ENGLISH GRAMMAR.

*Time 3 hours.*

EXAMINERS—J. Clark Murray, LL. D.,  
Rev. Prof. Scarth, M. A. Charles  
E. Moyse, B. A.

1. In adding a syllable to a word, (a) if the word ends in a consonant, when is the consonant doubled; (b) if it ends in *y*, when is the *y* changed into *i*?

2. Give the comparative and superlative of the following adjectives:—Sad, bad, fair, far, little, brittle, merry, gay, beautiful, ill, tall, late.

3. Give the present and past participles of each of the following verbs.—Seek, leak, feel, steal, lose, loose, tell, fell, hear, near, forsake, cut.

4. In the following verse point out, (a) the nouns, proper and common, (b) the adjectives and the nouns they qualify, (c) the prepositions and the nouns they govern, (d) the conjunctions and the parts of sentences they connect:—

“And when above the surges  
They saw his crest appear,  
All Rome sent forth a rapturous cry,  
And even the ranks of Tuscany  
Could scarce forbear to cheer.”

5. In the following sentence distinguish active, passive, transitive, intransitive, and impersonal verbs:—“It rained for a little as we began to ascend; but the sun dispersed the clouds soon, and we were almost oppressed with its heat.”

6. Explain what the two primary elements of a sentence are, illustrating by an example.

7. (a) Distinguish complex and compound sentences. (b) Of which sort are the sentences in questions 4 and 5?

8. In the following sentences select the words which enlarge the subject:—(a) Alfred the Great made many wise laws; (b) Impatient of delay they rushed unprepared to battle; (c) Rejecting with disdain the delicacies provided for his table, the king satisfied his appetite with common fare.

9. In the following sentences distinguish Direct and Indirect Object:—(a) Play me that old tune; (b) He taught his people the truth.

10. Correct the following errors:—(a) Neither of us were there; (b) Each of the members go away in their turn; (c) You are better entitled to the prize than her; (d) I seen him do it.

## ARITHMETIC.

*Time 3 hours.*

EXAMINERS—Rev. Principal Loble, D. C. L. G. H. Chandler, M. A.

1. Subtract the difference of 724809 and 347251 from their sum, and multiply the remainder by 207.

Express the result in words.

2. A tradesman receives on an average £70 15s. 8d. every day, and pays out £59 18s. 9½d. Find how much he makes in the year, deducting 53 Sundays.

3. Multiply 0721 by 3863.

4. Find the amount of \$7500 for 3 years at 6 per cent. per annum compound interest.

5. Find the price of carpeting a room 20 ft. 8 in. long, and 18 ft. 9 in. broad with carpet 27 inches wide at 5s. 3d. per yard.

6. If a family of 8 people consumes \$13 worth of flour in 6 weeks, how long will \$16.25 worth last a family of 12 people.

7. Three men build a house for \$6850, of which one furnishes \$3425, another \$2055, and the third \$1350. The house is sold for \$5400. How much should each receive?

8. The ditch of a fortress can be filled by one sluice alone in 12 hours and by another in 15 hours; in what time will it be filled by both open together?

9. Find the square root of 60.487129 to the third decimal place.

10. Express  $\frac{3\frac{2}{3}}{2\frac{1}{3} - \frac{4}{3\frac{1}{3}}}$  cwt. as the

decimal of a ton.

11. What is the greatest common measure of 204, 1190 and 2096?

12. What is each man's part if \$972 be divided equally among 108 men.

#### BRITISH AND CANADIAN HISTORY.

*Time—3 hours.*

EXAMINERS—J. Clark Murray, LL.D.,  
Rev. Prof. Scarth, M. A., Charles  
E. Moyse, B. A.

1. Name one celebrated Saxon, and one celebrated Danish, king of England, giving the century in which each reigned.

2. (a) What was the date of the battle of Hastings? (b) Who were the combatants? (c) What was the result?

3. In what reigns, and in what years, were Ireland and Wales respectively conquered and annexed to England?

4. Tell the origin and end of Wat Tyler's rebellion.

5. (a) What king of England was nicknamed *Crookback*? (b) In what battle was he killed? (c) What line of kings closed, what line began, with his death.

6. What great religious event took place in the reign of Henry VIII?

7. (a) Name in order the monarchs of the Stuart line? Which of them was executed? (c) What government

existed between his execution and the restoration of his son?

8. In whose reign, and in what year, did the American colonies declare their independence of Great Britain?

9. (a) What was the date of the battle of Waterloo? (b) Who were the combatants? (c) What was the result?

10. (a) Who was the immediate predecessor of Queen Victoria?—(b) What was the object of the Reform Bill passed in his reign?

11. (a) By whom, and in what year, was the St. Lawrence discovered?—(b) Why was it called by this name?

12. What were the date and aim of the "Quebec Act"?

13. (a) What was the cause of the war of 1812? (b) Mention any battle fought in Canada during that war.

14. In what year was the Dominion of Canada formed?

#### GEOGRAPHY.

*Time—3 hours.*

EXAMINERS—J. Clark Murray, LL.D.,  
Rev. Prof. Scarth, M. A., Charles  
E. Moyse, B. A.

1. What do you mean by Physical Geography?

2. Describe the origin of rivers. Define Watershed, Fork, Basin.

3. How are Bars and Deltas formed? Name the most important deltas of each continent.

4. What are the three main causes of variations in the temperature? Give illustrations.

5. State what active volcanoes exist in Europe. What proofs can you give of the presence of volcanic agency in Europe in the earlier stages of the earth's history?

6. Name the principal manufactures of England. State in what parts of the kingdom these are chiefly carried on.

7. Give the position, boundaries and political divisions of Asia.

8. What are the general character-

istics of Africa? Name the large lakes of Africa and the rivers which drain them.

9. Name the rivers of North America, classing them according to the gulfs and oceans into which they flow.

10. Name the provinces of Canada with capitals. Give date of confederation. Name the chief industries, and the principal lines of railway.

## ENGLISH LITERATURE.

*Time—3 hours.*

EXAMINERS—Rev. J. Clark Murray, LL.D., Rev. Prof. Scarth, M.A., Chas. E. Moyses, B.A.

1. State what you know concerning Chaucer's life and works.

2. Notice the chief features of English literature during the First Elizabethan Period, 1559-1579.

3. Name the authors of the following:—*Art of Poesie, Polyolbion, Lycidas, Principia, Dunciad, Religio Medici, Ralph Roister Doister, As You Like It.* In what centuries were they written? Add a note as to the character of each work.

4. Name eight great poets of the present century, and one poem of each.

5. What was the nature of the conversation between Ellen and the stranger at their first meeting?

(b) Describe the procession of Sir Roderick's barges.

(c) Narrate Brian the Hermit's acts and the substance of his words in Canto III (The Gathering).

(d) Who shot Blanche of Devan? What was her dying request?

(e) What part does Ellen play in Stirling Castle?

6. Explain the meaning of:—the tower on Shinar's Plain, I dæan vine, God wot, Hotspur's bows, bosky thickets, for battle boune, kern, a stag of ten, jennet, Tinchel.

7. Give a brief outline of the First Book of Paradise Lost.

8. To what ancient hosts does

Milton compare the array of fallen angels? How does he describe Satan's shield and spear?

9. Who pleaded for open war? his chief arguments? Who used "words clothed in reason's garb?" the chief points in his speech?

10. In what way does Milton make the fallen angels spend their leisure? Mention the four rivers of Hell, and state the meaning of each name.

11. Who kept the key of Hell-gate? What lay directly outside Hell? To whom did Satan speak just after leaving Hell? Why? What answer did he receive?

## ENGLISH LANGUAGE.

*Time 3 hours.*

EXAMINERS—Rev. J. Clark Murray, LL. D. Rev. Prof. Scarth. M. A., Chas. E. Moyses, B. A.

1. What does Peile say about *chamberlain, adder, hernshaw*, the suffixes *tar* and *ster*?

2. Apply Grimm's Law to *goose, deer, kin, heart, three*, and explain the results.

3. "The second great group of amalgamating languages is called Indo-European." Name the chief languages (living and dead) of this group.

(b) What is meant by the term Turanian as applied to languages?

4. "Light can be thrown on the history of this country (*England*) by the names of places." Prove the statement.

5. "A mass of conjunctions are obviously cases, generally of Pronouns." Give one example from English, one from Latin, one from Greek. (b) Why, is the term Pronoun, as generally understood, inaccurate?

6. The Second Lecture in Trench deals with the poetry in words. Give six of his examples and explain them.

7. "What a record of inventions, how much of the history of commerce is preserved in names!" Derive ten of these.

8. What is the difference between *contrary* and *opposite*; *education* and *instruction*; *abdication* and *desertion*?

9. What does Trench say about *apis*, *crypt*, *post*, *stock*?

10. Name the Relative pronouns and point out their uses. Tell what you know concerning their history.

11. What do you know concerning the history and use of the Infinitive mood, the Gerund or Verbal Noun, the Present Participle?

12. Compare three Adverbs in the regular mood, five "irregularly," and name two which show defective comparison.

13. Derive two Adjectives from Nouns; two Nouns from Adjectives; two Verbs from Adjectives; two Verbs from Nouns.

14. Analyse grammatically:—

'Life, like a dome of many coloured glass,  
Stains the white radiance of Eternity,  
Until Death tramples it to fragments.—Die,  
If thou wouldst be with that which thou dost  
seek!

#### GENERAL HISTORY.

*Time 3 hours.*

EXAMINERS—Rev. J. Clark Murray, LL. D., Rev. Prof. Scarth, M. A., Chas. E. Moyes, B. A.

1. Who was the great Spartan law-giver? What regulations did he make concerning the use of money? What was the nature of Spartan life and education, and what its aim?

2. In the Persian invasion of Greece, state in what great battles the invaders were defeated. and give dates.

3. Who was Epaminondas? What were the results of the battles of Leuktra and Mantinea?

4. What story do the Romans tell about the founding of Rome? How long was she governed by kings? Who was the last king?

5. What great wars had Rome to wage before she became mistress of Italy? What were the two ways by which she kept Italy under her power?

6. Mention some of the changes made by Diocletian in the plan of the Roman government.

7. When and between whom was the battle of Chalons fought? Who was the last emperor of Rome? Give the date. State who was proclaimed king of Italy in his stead.

8. Give an account of the origin of the Crusades. The date and history of the first? How many Crusades were there?

9. Give an account of rise of the Dutch Republic.

10. Give an account of the Russian campaign of 1812.

#### THE GOSPELS.

*Time 1 hour.*

EXAMINERS—Rev. J. Clark Murray, LL. D., Rev. Prof. Scarth, M. A., Chas. E. Moyes, B. A.

1. State what you know of the birth and childhood of our Lord.

2. At what age did our Lord enter upon His public ministry? How long did it last? What circumstances immediately preceded it?

3. Give an account of the Lord's first miracle. Where was it wrought? When were the greater number of his miracles performed?

4. Relate the parable of the "ten virgins"? What is a parable?

5. Can you give the account of our Lord's last appearance to the Disciples at the Sea of Tiberias, and His solemn questions to Peter on that occasion?

#### GEOMETRY.

*Time 3 hours.*

EXAMINERS—Rev. Principal Loble, D. C. L., George H. Chandler, M. A.

1. Draw a straight line at right angles to a given straight line from a given point in the same.

2. The greater side of every triangle has the greater angle opposite to it.

3. If a straight line falling on two

other straight lines makes the alternate angles equal to one another, the two straight lines shall be parallel to one another.

4. Equal triangles on equal bases in the same straight line, and on the same side of it, are between the same parallels.

5. Describe a parallelogram equal to a given rectilinear figure, and having an angle equal to a given rectilinear angle.

6. If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the two parts.

(a) The square on any line is equal

to four times the square on half the line.

7. Divide a given straight line into two parts, so that the rectangle contained by the whole and one of the parts may be equal to the square on the other part.

8. One circumference of a circle cannot cut another at more than two points.

9. If a straight line touch a circle, the straight line drawn from the centre to the point of contact shall be perpendicular to the line touching the circle.

10. If two straight lines cut one another within a circle, the rectangle contained by the segments of one of them shall be equal to the rectangle contained by the segments of the other.

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## STOCK COMPANIES.

BY T. A. PUGH.

### I. *How stock companies are organized.*

A stock company is an association of individuals united to transact a certain business under given regulations. A charter is the legal document which defines the rights and obligations of a corporation. Dealers in stocks, bonds and annuities are known as stock brokers and stock jobbers. In New York the traffic in stocks is of two kinds, the regular sales at the first and second boards, and the operations of the street. The first are legitimate and the sales are presumed to be *bona fide*; the second are generally speculative and are often mere gambling or betting by men without capital. The board of brokers in New York is composed of more than 1,000 members. It has a president, secretary, treasurer and governing committee of 40 members who are the executive of the exchange, and can admit, expel and readmit members.

Next in importance is the sub-committee of arbitration which decides all

disputes arising from transactions between members. When a member fails to deliver or pay for stocks as agreed, his name is struck from the list; but he may be reinstated upon effecting a settlement with his creditors.

The New York stock exchange is the wealthiest organization of the kind in the world. The par value of annual sales made at the boards and "over the counter" is estimated at more than \$22,000,000,000.

The rules of the organization are very strict, and cover a rigid scrutiny of all securities, a surveillance over members in respect of their fidelity to contracts, and a stringent examination of the character and responsibility of candidates for membership. An applicant for membership must be 21 years old, a banker, broker or stock dealer in New York for one year, or a member in good standing of the Philadelphia, Baltimore or Boston board.

The initiation fee of a member

admitted by election is \$10,000, and one admitted by transfer is \$500.

During business hours the board is in constant communication with the financial centres of Europe, and the brokers pay \$1,000,000 a year for telegrams from London alone.

Having considered the organization and the laws regulating the company, it may not be uninteresting to notice :

## II. *The peculiar terms used by the Stock Exchange.*

Among those in most frequent use are "long" and "short," expressing individual excess or deficiency in the holding of a specified stock for speculative purposes; and "bull" and "bear," designating those respectively who find their interest in operating for a rise or fall in the price of stocks, or who, foreseeing either a rise or fall in the price of stocks, take measures to make a profit on the "turn of the market." The bull endeavors to appreciate or "toss up," and the bear to depreciate or "pull down" the price. The phrase "buyer's option," added to the memorandum of a sale of stocks, implies that the purchaser who buys at 30 or 60 days can call for the delivery of the stocks at any time within the period by giving one day's notice and paying interest at 6% up to the time he calls. Such purchases are usually made at a little above the cash price.

"Seller's option" is a little below the cash price, and the seller has the right to deliver on any day within the limited time, by giving one day's notice, receiving interest up to time of delivery.

A "corner" is an operation by one or several brokers who form a clique to compel others to pay a heavy difference on the price of stock. Sometimes the clique purchase gradually a large amount of stock on time, buyer's option; they next sell nearly the same amount on time, seller's option, so as to secure an eventual market for their stock; then buy for cash, thus raising the price, and make a sudden call for the stock

they have purchased on buyer's option, which, if they have calculated correctly, compels the parties from whom they have purchased to buy of them at a high price in order that they may deliver at a low one.

"A point," the first element of successful speculation, is trustworthy private information concerning a certain stock, such as whether a bull movement is organizing, or an extra dividend is to be declared, or new stock is to be issued.

A "lame duck" is a broker who is unable to respond with the shares or money when contracts mature.

A "spread eagle" is the operation of a broker who sells a large quantity of stock on time, say 60 days, buyer's option, and buys the same quantity at a lower price, on the same time, seller's option. If both contracts run their full time, he makes the difference; but if the buyer or seller calls for a settlement before the time, he may be seriously embarrassed.

"Put," "call," "ballooning," "saddling," "unloading," and forty other terms make up the dialect.

## III. *Stock Companies in Europe.*

Among the most noted are Paris, London, Berlin, Amsterdam, Frankfort, Madrid and Vienna. In Paris there are 60 members appointed by the government. Each must deposit 125,000 fr. in the national treasury as a guaranty of upright conduct. A broker's seat is worth from 1,500,000 to 2,000,000 fr. and cannot be sold without the consent of the governing committee.

Cash sales are infrequent, and the greater part of the business is "privilege," the buyer deciding on the 15th and 30th of the month whether he will take the stock or not, but in either case having to pay the premium. The time transactions are usually made "the end of the current month," or the end of the next month. The 4th of each month is settling day. The *parquet* is in session from 1 to 3 p. m. of each

day; the *coulisse* is in session through the day and it includes a large number of female jobbers and speculators. The excitement at time of "high change" in London, Paris or New York is often such as beggars description; several hundred men are shouting, calling out what they have to sell or what they wish to buy, at the top of their voices, all together, and leaping and gesticulating, almost as if insane; in speculative periods immense sums are made or lost in a few minutes.

#### IV. How to make this practical in the Arithmetic Class.

When this subject comes up the teacher may organize a stock company. Let the class elect all the officers. The teacher must, of course, oversee the work. Take pieces of white paper and give values to them such as \$1, \$5, \$100, etc.

Book-keeping can be studied in this exercise, and many other things which the judicious teacher will bring in as collateral instruction. Let the pupils

actually transact business, buy and sell shares, admit new members, etc. Suppose the stock of the company to be \$25,000. Numerous examples can be put to the class. The company can declare a dividend of 5½%, then let each member receive his dividend; i.e., let the money be counted out to each one. You will be amazed to find how little the average pupil knows about counting money. But you must not expect to have such a stock company in your school as there is on Wall Street, New York. You are only to get out of that old routine way of teaching. You are to be content with small results. To show the pupil what the duty of an assessor is, elect an assessor in the school. Let him prepare a list of the names of his schoolmates, and assess their personal property, such as books, slates, pencils, etc.

This will give the scholars a better idea of it than you can give by lecturing, besides it will please them to do the work.

### OBJECT TEACHING.

*The Great Error in our Systems of Primary Instruction.*—We believe the great error in our systems of primary instruction is the prevalent idea that we should view every subject as a completed *science*, that we should then reduce the science to its so-called *elements*, and begin our teachings with these. But this is a total inversion of the order in which every science has been built up in the growth of the race, and opposed, also to the order of mental development, and, consequently, to the principles upon which knowledge is acquired by the individual. What we now call the *elements*

of a subject are the expressions of its general truths—the final results—the few general facts or principles which science has deduced from a large collection of facts after the structure has been completed; and as neither nations nor individuals arrive at these elements first, so they should not first be presented to children. What are the *elementary sounds* of our language but the results of investigation by scholars after the language had attained its present degree of development? And yet, even scholars do not agree as to the number and character of these sounds, nor are they the same in all lan-



guages. Let us bear in mind that the *rudimentary facts* of a science are one thing, and its *elementary principles another*: the *facts* are the first things learned, and by simple perception; the *principles* are the last things learned, and they are acquired by a much more advanced mental process—that of generalization. *Nature*, dealing only with facts, teaches the particulars, and then *we* make the generalization. Hence we see why our perceptions are right, and why our rules and principles are often wrong.

We remarked at the outset that the system of "Object" teaching is not new in principle, and that it is not only carried out in Nature's teachings, but that it is the system upon which nearly all valuable knowledge has been accumulated in the progressive civilization of the race.

*All Science built up on the "Object" System.*—All science has been built up upon this system; all original investigators and discoverers even now adopt its methods; it is only when we come to elementary instruction of the school-room that we depart from its principles. Let us bring up a few cases in illustration.

If we look at the science of *botany* we shall find that it has grown from small beginnings by a close examination of the *objects* themselves. Amid the infinite diversity which the vegetable world presents, certain points of resemblance were at a very early period noticed by the most casual observers, sufficient to form the basis of some sort of a classification, even though it may have been as rude as that given by the poet Cowley when he divided the vegetable world into three great classes—herbs, flowers, and trees. But when Linnæus, and after him Jussieu, laid the foundation of the science of botany as it now exists, it was not by speculative theories formed in their closets, but by a close observa-

tion of nature herself—such a course as we have attempted to sketch the outlines of in the lessons on several of the charts in this series. Look at the "Forms of Leaves," as presented on a "Botanical Chart." All these were closely examined in the natural objects themselves by the early botanists, and names given to them. Thus, different species of plants were found to vary in the general forms of their leaves, some ovate, some cordate, or heart-shaped, etc.; some species were found to have their margins entire and unbroken, others had them variously toothed or serrate; in some species the tips of the leaves were sharp-pointed, or mucronate; in others blunt or truncate; and in others, notched, or emarginate; but in all the individuals of each species the family resemblance was so uniform as not to be mistaken. Yet not a step could be taken in building up the science of botany until all such particulars, and others similar to them as to the forms of the stems, flowers, roots, etc., were noticed. And if children would have the most accurate knowledge of the forms and colors, and other characteristics of individual plants, they must be led to notice the real plants themselves, or their representations. Mere description is, for the young, a very poor substitute, although it may answer, where nothing better can be had, for the mature scholar, who, having carefully observed one thing of a kind, is prepared to judge of all others of the same kind by it; just as a child that has closely examined one labiate flower is prepared to judge of all other labiate flowers by that one; and when he sees a certain leaf, and is told *that* particular form is called *elliptical*, he knows the shape of any other leaf that is described as being elliptical, and of anything else in nature that is so described. It is very apparent, therefore, that the true method of instruction is to present the *object* first, or the

representation, if the object can not be obtained, and not the description. First the *idea* is to be acquired, and after that the *words* which represent it almost spontaneously follow.

This is as true, both of the method of discovery, and of all approved subsequent study, in all other sciences as in botany. Not only did the discoverers in anatomy examine every bone, and nerve, and muscle, and vein, and artery, and notice their varied uses, and their conditions of health and disease, but we think it necessary that students in anatomy at this day should pursue the same course of instruction. Does not the geologist examine the rocks themselves: the astronomer turn his telescope to the heavens, that he may see with his own eyes; the chemist go over in his laboratory the experiments of his predecessors; and the scientific farmer study the conditions of vegetable growth in the analysis of soils and plants, and in experiments based on what he thus learns? And if "seeing is believing," and leads older students in the most direct road to knowledge, does not the same principle hold good with children; and ought we not, as far as possible, to pursue the same system in their education? Let them learn by the evidence of their own senses as far as they can, for then they will be apt to learn aright. In the knowledge thus acquired they are always interested. To *see* is to know, but that which is merely *told* is often unheeded, misapprehended, or disbelieved. We see, therefore, that Nature teaches, and that science progresses, from the observation of the rudimentary facts, upward to the rules and principles which are the generalization of them. And why should we in our school instruction, invert the order?

*Why Science is adapted to Childhood.*

—It is easy to see that, when presented in the true inductive order, all the natural sciences, which are built up of *facts* from the great book of Nature, are peculiarly adapted to the capacit-

ies of childhood — giving constant activity, as they do, to the perceptive faculties, and storing the mind with materials for the further exercise of memory, comparison, association, imagination, reason and judgment. Many subjects, which are put far advanced, even in the curriculum of college studies, by reason of the *inverse* order in which they are presented in books, are thus seen to be connected with the common matter of every-day life, and their rudimentary facts to be constantly passing under the observation of children. A little pebble is a very common matter, which children often handle with little interest; but connect it with the geological history of our earth—show how, in some deep and quiet sea of a bygone age, it was slowly deposited, particle by particle, and finally became hardened into stone—show the strange animals and plants that were its contemporaries—how it was subsequently broken from its rocky bed; and after being tossed and buffeted by the waves for ages longer, until, worn into its present form, it was left where you chanced to find it—and it at once becomes an object of curious regard in the eyes of the intelligent child; for in its little self it presents the records of a history wonderful and grand in the extreme. Thus every plant from the fields or wayside, and every star that twinkles in the evening sky becomes a rudimentary fact of scientific knowledge—a fact which even *children* can comprehend. What we need is to present such fact, (and there is a boundless store of them ready at our hands) in their appropriate order, in a system of primary instruction. Let our reading books prepare the way for this system, both for teachers and pupils, by giving *to all* some little insight into the mysteries contained in the great volume of Nature, which, unhappily is yet a sealed book to many of our educators themselves; and then let the system of "Object" teaching now being inaugurated, work out the details.

## SHOULD THE "INTERMEDIATE" BE CONTINUED?

*(From the Educational Monthly of November.)*

WE propose this month to state briefly—for the last time, we trust—the prominent objections to the "Intermediate," omitting those that hold against any mere written test of the condition of a school:—

I. Intended to serve as a promotion examination which an ordinary High School pupil might pass after a two years' course of study, it has never been so. The rigidity of its tests and the impossibility of preparing ordinary pupils in the time for the examination, has prevented this. A clever boy or girl may pass after two year's study, but the average High School pupil, for whom the schools are specially intended, cannot do so. Further it ignores some very important subjects of study and gives undue importance to others. Reading, Writing, Drawing and Music have no examinational value, and are practically dead in our High Schools. It has been said by one of the High School Inspectors, that the examination craze has gone so far that in teaching French many Masters do not trouble themselves about the pronunciation, on the ground that it does not pay. Then again, as Messrs. Marling and Buchan have stated, too much attention is bestowed on Mathematics, and English Composition, English Literature, and the *litteræ humaniores* generally, do not receive the proper amount of attention.

Many pupils, too, fail at this examination who are more worthy of promotion than many who pass. The master must, therefore, ignore the examination in his arrangement of his classes, or keep his pupils for another year at the same work, whether parents

wish it or not. In the former case the school will lose part of the grant on Upper School attendance, and in the latter the pupil's education will be retarded. As the Master's ability is appraised according to his success at the "Intermediate," we say deliberately that he will be a most Quixotic man if he do not consider his own interests. In a large school the evils are becoming simply unbearable. To the knowledge of the writer some Institutes have been forced to adopt the following plan:—The Master makes up the number the public expects him to pass, by foraging for and securing candidates for Second Class Certificates, and if his High School pupils proper fail to pass, he promotes them without regard to the examination. We hold that the Master should be allowed to arrange his school without any regard for examinations other than the entrance and leaving examinations. The "Intermediate" would be less objectionable if it were the *end* of the High School course, as the High School Entrance one practically is in the case of the Public Schools; but its infliction when it now takes effect, is a most unjustifiable interference with the master's liberty of action.

It is perfectly true that, so far as the subjects it embraces are concerned, the "Intermediate" may in some respects suit schools that do not attempt higher work than it entails upon them. It is their Leaving Examination, but it is a most serious injury to the schools that take up the present Upper School Programme. The "Intermediate" is not a promotion examination, and the Department has not succeeded in

making it one after nearly six years' experience. The Department has, therefore, no right to throw the schools into confusion for two or three months in the year.

2. The "Intermediate" seriously interferes with classical culture. It has done a good deal for English and Mathematics—for the latter in particular; but anyone who examines the University Matriculation Class Lists will see, that if Classics are not being less attended to than they were, they are not advancing *pari passu* with other subjects. This cannot be justified. Few men who have not a good Classical education can have real culture. Many men, indeed, who have not the former think they have the latter; but this is quite a natural mistake, under the circumstances.

If the Minister of Education continue the "Intermediate," he will seriously impair classical education in Ontario. Greek is not one of the subjects prescribed for the examinations, and consequently, its study must be deferred until the pupil have reached the Upper School, or he must run the risk of being plucked at the Intermediate. In a properly organized school Greek should be begun after from six to twelve months' study of Latin. As matters stand, it cannot be taken up until the pupil has reached the "Intermediate" stage; for we seldom find a boy able to take Greek and keep at the examination point all the English and Mathematical subjects. The fact of the matter is, when the "Intermediate" was devised, it was intended mainly to promote the interest of an ordinary English education, with Latin as a Modern Language. English and Mathematics alone are all very well in their way; but the man who knows little of the ancient Classics can have but a poor appreciation of the former; and most people believe, with Holmes, that "the power of dealing with numbers is a kind of 'detached lever'

arrangement, which may be put into a mighty poor watch." The difficulty we are discussing is no imaginary one. It affects the best schools, and Masters who try to do a good deal of classical work find the "Intermediate" a source of great embarrassment.

3. The "Intermediate" renders it impossible to teach Natural Science as it should be taught. Chemistry in our schools is little better than hybrid arithmetic; and Botany has neither a local habitation nor a name. To the knowledge of the writer, pupils have often obtained 75, 80 and 90 per cent. who have never seen a single experiment. Under these circumstances they cannot be induced to study it practically. Experiments they value merely as aids to the memory. Before the inauguration of the present system, Chemistry and Botany were taught well in at least a few of the schools. Now the case is different. In one school we know of there was for a time a class of young boys who had been so trained that by the blow-pipe as well as by wet tests they could analyze ordinary substances. The "Intermediate" killed this, the only true method of study. There are few better instruments of education than Natural Science, but the mongrel article that now exists amongst us has little value.

4. The public have been led to judge of a school's efficiency by the number the Master succeeds in passing at the "Intermediate," and the evils resulting from this have intensified by attaching a money value, in which Trustee Boards are directly interested. This state of matters is directly chargeable to the Department. The High School Inspectors, in the report they made to the Council of Public Instruction, say in regard to the examination: "It will shew the country what schools are really doing High School work. It will stimulate the Masters by a direct pecuniary result." The press,

and the *Globe* in particular, have aided this movement. For some years after the inauguration of the "System," the half-yearly results were paraded and commented on by the Government organ. Even the total number examined and the proportion passed were supplied for the information of the public and the delectation of the Masters. From this state of matters, we assert, the following evils amongst others have arisen :—

(a) A wrong ideal of what High School work should be, has to be set up and worshipped by the Masters. Many direct all their energies to preparing for this examination, and have refused in some instances to take up work beyond it. From a statement submitted by the Minister to the Executive Committee of the High School Masters, we find that out of 105 High Schools and Collegiate Institutes, only *ten* for the first half of 1880, and *fourteen* for the second half, had an Upper School average attendance of *ten* and over. This speaks volumes. There is reason, too, to believe that the number of High Schools sending Honor candidates to the Universities is diminishing. The total number of candidates is not less, but they come from fewer schools.

(b) The tendency is to neglect pupils whose intelligence is a little less than the ordinary "Intermediate" *quantum*. The master is driven to concentrate his energies on those who are likely to pass. That this spirit prevails is an undoubted fact. How can it be otherwise? One of the High School Inspectors, at a meeting of the High School Committee held in Toronto about four years ago, referred to these results, and to the amazement of all who heard him, justified this grotesque and immoral application to education of the Darwinian doctrine of Natural Selection. We take another view of the question. Apart from the religious aspect of the matter, we hold that it is a man's chief

end to benefit his fellow-men, and that the master's duty is to do all in his power to help the stupid and energize the indolent. The clever boy can take care of himself. The larger proportion of our pupils are of very ordinary ability. It is not one in four hundred that has really good mental powers, and no system of education should be tolerated for a day that puts on the teacher the pressure we object to. It would be worth the Minister's while to find out how many genuine High School pupils pass the "Intermediate." The statement of results does not separate them from the teachers. We have taken the trouble to find out the proportion in a good number of schools, and we have reason to believe that from sixty to seventy per cent. of those who pass are teachers. The exceedingly small number who remain for Upper School work would shew this, if there were nothing else to justify us in our view of the case. In estimating the good effects of the "Intermediate," it should not be forgotten that, after the first examination, the Second Class Teachers' Examination was combined with the High School Promotion Examination. We maintain, therefore, that the boasted progress of our High Schools is more apparent than real. Not more than 150 or 200 of the 700 who really passed last July were genuine products of the High School system.

(c) The candidate for a Second Class Certificate has become an object of absorbing interest to the Master, who knows that the teacher who has been ordinarily diligent since he obtained his Third Class, can take on the required amount of polish in about six months. Crowds of this species of "Intermediate" candidates enter the schools at Christmas, and "go in for a regular cram" till July. The boy and girl of tender and immature intellect are classed with them, and either fall back discouraged or run the risk of mental injury. Experience shews us

that the High School Masters were wrong in desiring the amalgamation of the two examinations. The class of pupils for whom the schools were designed suffer in the struggle. The preparation of candidates for Teachers' Certificates must be made a subordinate element in the Masters' calculations, not the chief one as it is now.

(d) The Masters must teach for the examination and the pupils must study for it. It is a stimulus, there is no doubt whatever. But it prevents the proper kind of teaching from being done, by confining the Masters' efforts to the narrow rut worn out from year to year by the Examination papers; while the pupil generally falls back into lethargy when it is withdrawn. It is very difficult to get pupils to continue their studies now, unless some examination be held up as a motive for exertion. Love for learning is practically non-existent in our High Schools. Ask a boy to study and he will tell you he doesn't want to pass any examination. "What's the use? I don't want to be a teacher. I don't want to go to the University."

(e) Not the least deplorable result is that this examination, which is no test of the real condition of a school, and no test of the ability of the Masters, is regarded by the public as *the* Test. The only way to cure this is to abolish the cause, for it cannot be modified so as to meet the objections. No examination can possibly be devised that will gauge the results of honest educational effort.

(f) We hold that the moral tone of both Masters and pupils has been lowered. It is notorious that copying and other irregularities are largely practised in many localities, winked at by sub-examiners and undetected by the Department. The investigation now going on at Owen Sound shews this clearly, and we fear there can be little doubt that the condition of school morality in many other places is little

better. Examination frauds are the natural outcome of this state of affairs. The Master, too, is often "up to all sorts of games" in publishing the results. The local paper abets him, and jealousy, ill-will and misrepresentation prevail.

The "Intermediate" has certainly done good; no one will deny this. We maintain, however, that the evils we pointed out (and more might be added) far more than counterbalance the advantages. The Education Department theory seems to have been that the High School Master is an arrant knave—a man of undoubted acumen, but "for ways that are dark and for tricks that are vain," a regular Heathen Chinee—a development of the species Schoolmaster that must be carefully watched and hedged in—a man who must be made honest by compulsion and moral by Educational Office Regulations. We would suggest that the time has come to give him a chance. The High School Master is just as moral as most men and just as faithful. He has at any rate proved himself to be a better judge of what our schools need than the officials who have brought about the present wretched mess; for the Masters as a body opposed "Payment by Results" from the very first, mainly on the grounds we have urged.

The advocates of this so-called "system" point to the general advancement of education as the result of the "Intermediate." We have shewn that the results are more apparent than real, and we maintain that the recent changes are due mainly to the provisions of the Revised School Act, that gave High School Boards the right of taxation. This is what gave the impetus to our schools. The High School Entrance Examination has also done much, for the School system is now a series of graduations, and a very large proportion of our High School pupils are doing little more than Public School work. Omit-

ting a smattering of French, German and Latin, what difference is there between the First and Second Forms of our High Schools and the Fifth and Sixth Forms of the Public Schools? The schools have settled into their present relations since the inception of the "Intermediate," and it is since then that the "utilization" of the High Schools has taken place.

As a solution of the difficulties we propose the following changes, the latter of which has already been advocated by the High School Masters' Section.

We may observe parenthetically that it is true that, by a vote of ten to nine (many not voting at all), all the same Section asked for a grant of \$3 in case of each pupil that might succeed in passing the "Intermediate." This, however, would not have passed in a full meeting and was agreed to by the above vote on the supposition that the Department had determined to maintain the Examination, and thus in this way some of the smaller schools, which would have no chance of the Collegiate Institute Grant, would receive a larger share of Government support.

#### PROPOSED CHANGES.

I. *The abolition of the "Intermediate" as a High School Promotion or "Inspectorial" Examination, and its retention for Teachers' and Primary Professional Examinations.*

In this form it may still do a great deal of good—more, probably, than any other examination we have, for it would be more general in its operation. It would be an important agency in the advancement of education in all our schools, and particularly in those whose highest limit is this examination, while it would not interfere with the systematic development of those institutions that aim at still higher work. In our High Schools and Institutes there are many pupils in the most advanced

classes who do not intend to present themselves for examination, and whose sole object should be to obtain a good education. The fact that there are pupils in these classes who do not intend to compete at the University, affects the character of the work, and provides for the Master the stimulus which the Department has always maintained he stands in need of. This examination will have the same effect on what is now called Lower School work. It will still be an object of the Master's ambition to pass a good number for Second Class Certificates, but it will be an optional matter with both him and the pupil whether the latter pass it or not, and the former will be at liberty to allow that gradual development of the pupil's mind which is so desirable. Overwork and Cram—the present curses of our system—need no longer exist. Classics and Natural Science may be taught, as they should be taught; and High School Inspection, which many now regard as a delusion and a mockery, may acquire some real value. The Inspectors will have to do their own "Inspectorial Examinations," and will be afforded a chance to justify an office which at present does not recommend itself on account of its public usefulness. The Inspector's function should be an important one; but, under the operation of the "Intermediate" it has become "an airy nothing."

II. *The distribution of the Legislative Grant on the basis of the amount paid as Teachers' Salaries.*—As we stated last month this varies in the long run, directly as the *quantity* and *quality* of the work done. We think there should be both a minimum and a maximum grant. The instability there has always been in the amount of Government aid would in this way be remedied, and Boards would feel that their efforts would meet with proper recognition. Salaries would undoubtedly go up—not necessarily in the best schools, but

in those where an increase is most needed. Any defects in the administration of a school would be remedied gradually, and subjects that are now neglected would be attended to. If a Board thought well to employ a music-master, a drawing-master, or a drill-sergeant, it might rest assured that its expenditure in this direction would cause a proportionate increase of Government aid.

The objection, too, would be made that for some reason or other is now being urged in one quarter, that there is a marked discrepancy between Government aid in some High Schools and the population of the counties in which they are situated. If a county received only \$800 from Government, all it would have to do would be to increase its teaching power, and this it would not do unless there were a real necessity. No Board would spend \$1,200 to get \$700 or \$800 from the High School fund. We hold that no grant should be given on average

attendance. The Legislative Grant should be distributed under regulations of the following nature: A school with two masters should receive at least \$400; a school with three at least \$800—and so on—with a prescribed *maximum* attendance in each case. The minimum may be disregarded. Boards do not err on the side of giving their teachers too little to do.

Briefly stated, the principle that should guide the department is this: Education should be left as much as possible to local control. We have had too much of the bureaucratic system. We may also add that the High School masters as a body do not propose to tolerate the unjust treatment to which this pestilent system has subjected them. The question will not be allowed to rest until the Minister rectify abuses for which, it is but fair to say, he will be responsible only if he allow them to go on. They are a legacy which he inherited, not creations of his own.

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## DEFECTS OF OUR SCHOOL SYSTEM.

### CRAMMING.

IN one of the leading journals of the day, attention is directed to some of the defects of our educational system. From the defects, many evils have resulted, and chief among them the evil of cramming. That cramming is an evil, few educationists are prepared to deny, though it has found some apologists even among these. One ingenious writer, in order to weaken the force of the strictures upon it, with true metaphysical subtlety, divided cramming into two kinds, good and bad. It is the latter we have to find fault with; the former is not cramming at all. Another, in extenuation of the practice, cited the cases of a lawyer

cramming his brief and a clergyman his sermon, as similar to that of a child cramming his lessons. Comparisons are odious. The parallel does not hold good. The object before the child in study is two-fold: to develop his intellectual powers, and to acquire knowledge which he is to retain. There is a great difference between the undeveloped powers of the child and the fully matured and cultivated faculties of the man: the man hastily acquires information in order to as hastily forget it, and if the child pursues a similar method, a similar result will follow. Such extraordinary mental exertions are rarely made by the man, yet they



would require to be daily made by the child. The clergyman can preach in many instances without lengthy preparation because he is full of his subject. The lawyer is already familiar with law, and he has merely to make the application of general principles to particular cases. The child on the contrary has nothing to assist him in the acquisition of new ideas or if he has something, is prevented from utilizing it by the pressure of cramming.

No athlete would ever think of training by subjecting himself to the constant overtaxing of his system. Nothing would more surely defeat the end he had in view. Yet it would be quite right in the opinion of some authorities to exact from the tender unformed mind of the child more work than it can properly perform, and that too for years.

We may consider more minutely the effects of cramming upon the pupils. We remark first, that accuracy and thoroughness are incompatible with cramming. Nothing could well be more destructive to accuracy than the pupil's being compelled to do more work than he has had time assimilate and master. Instead of having clear and definite ideas upon any subject, he will have only a chaos of things in his mind from his never having had time for reflection and arrangement.

Secondly, cramming stunts the reasoning powers of pupils. This is almost a self-evident proposition. The crammed pupil has to depend more upon his memory than his reason. All difficulties are smoothed away for him by the teacher anxious to distinguish himself at the examinations. All teachers in High Schools or Collegiate Institutes situated in towns or cities recognize the truth of this proposition at once. They have pupils from town and country. From the system of graded schools which have been introduced into all towns and cities, the facilities for cramming in city schools are superior to those of

country schools, where one teacher has to teach all classes and subjects, and where consequently a pupil can receive but a limited portion of his time and attention. The difference between country and city pupils is marked. The former are characterized by greater energy and greater thinking power, and their progress compared with city pupils seems marvellous. That this difference arises from the fact the former are uncrammed there seems no reason to dispute. It may be objected to this deduction that the country pupils who do attend city schools are for the most part the cleverest of all country pupils. This does not constitute a valid objection, for in proportion to population there should be as large a number of clever pupils in cities as in the country, and yet we find country pupils distinguishing themselves among those of equal natural ability and of presumed superior training.

Thirdly, cramming renders pupils listless in their work and superinduces a state of mental *coma*. School-work is made irksome to the large majority of children by the strenuous and incessant efforts they have to make in the preparation of their daily lessons. The stimulus of curiosity is lost and the teacher is deprived of a valuable auxiliary in his work. It is an impossibility to maintain the interest of children kept continually on the rack.

Fourthly, cramming has an injurious effect upon the health of children. Upon this point all physicians of note are agreed, and we do not require to expatiate at length upon this phase of the evil.

The evil of cramming is clearly then one that is subversive of all the true aims of education, and would not be resorted to were it not for the fictitious importance that is attached to the proficiency of pupils on paper. That this evil is one that permeates our whole public school system, is the testimony of impartial observers, and

we may therefore enquire into its origin. We have not far to seek for explanation of its rise. It is undoubtedly the natural result of the school legislation of the last few years.

One great cause has been the multiplicity of subjects prescribed by the Education Department. Our educational authorities, fired by a noble zeal to emulate the school system of the United States and to surpass the systems of the effete and worn out monarchies of Europe, have inserted on the school programme such a variety of subjects as would, if thoroughly mastered, turn out a nation of admirable Crichtons. Some of the chief advisers of the Minister of Education were no doubt sincere in advocating such a multiplicity of subjects as they have felt the want of some such comprehensive course of study in youth. The truth seems to be that with a view to effect, characteristic of its exhibition displays, the Education Department has tried to be brilliant at the expense of the unfortunate school children. The child, distracted by the great variety of subjects, makes no permanent progress in any. It is true that the number of compulsory subjects has been recently limited, but ample scope is still left for the enterprising teacher or inspector to insist

on the teaching of all the subjects mentioned in the curriculum.

Cramming has also been fostered, if not chiefly caused, by the various departmental examinations. The examination for entrance into High Schools, placed as it is practically at the end of the public school course, serves as a perpetual incentive to cramming. The examinations for second class teachers' certificates and for intermediate have a similar effect in High Schools. The inducement to cramming is thus present in both public and High Schools, and the unfortunate pupils are subjected to it during their whole school life.

Another movement which promises fair to promote cramming is the introduction of uniform promotion examinations in county public schools. This system already exists in cities, and with what general results we have already seen. The danger of cramming would form a strong argument against the introduction of this scheme, and it would be an insuperable one if no means could be devised to prevent cramming. We have thus hastily demonstrated the cause and the evil effects of cramming in the present paper, and in our next we intend to devote some attention to the evils of examinations as at present conducted.

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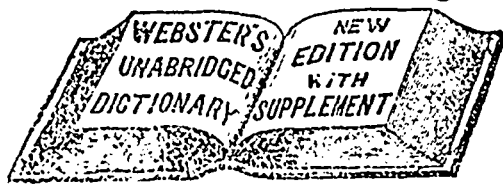
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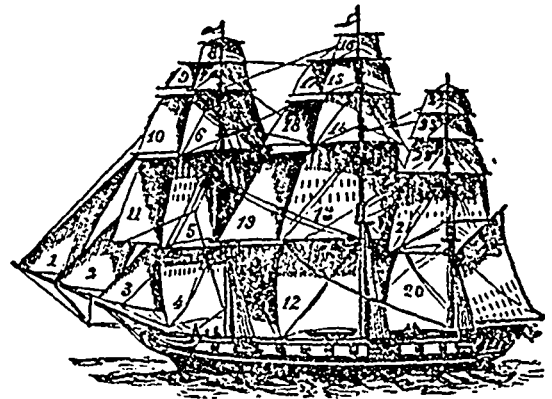
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