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THE SCHOOL MAGAZINE.

FEBRUARY, 1880.

THE VERB.

(Continued from last Number.)

TO trace all the shades of meaning that these verbs have assumed, and the methods by which they gradually relinquished their notional force as principal verbs and became mere auxiliaries, would be beyond the scope of this short sketch, though it is a subject that would amply repay investigation. Their employment is an expedient resorted to at all times, and in all languages, to supply the defects, or the want of inflection. Compared with inflection, they add a clumsy appearance to a language, but they give a straightforward simplicity, a minute accuracy, and a forcible expression, that no inflection ever could do.

The variety of their use may be exemplified by the use of the word *do* as an auxiliary. From meaning 'to make,' or 'cause,' it gradually lost its force, until it became a mere auxiliary, even being used as an auxiliary to itself, as in, "If they were to do as you, they would do better than they *do do*." This example also represents the habit of using "do" to represent any verb that was not repeated, though in reality the verb is always omitted after "do. From the frequent use of "do" in this way in strong asseverations, it acquired more emphasis, thus giving rise to our emphatic form.

Perhaps the most peculiarly idiomatic use of this word, is its employment in the formation of the negative and interrogative forms. No other language has anything resembling this. In investigating the origin of these forms, we must remember that the early language was a time of expedients to supply the loss of inflections. It was the birth of a new system of grammar—a fact but reluctantly admitted by grammarians who were long wont to look to Latin construction as the perfect model of grammatical purity. This mistaken idea has been the cause of immense delay in arriving at a just estimate of our many peculiar idiomatic expressions, but we seem finally to be sated with the classical mania, and grammarians are more alive to the fact that however exact Latin grammar may be for its own language, it is simply a detailed account of the results of a long series of corruptions in the Latin language. English grammar is the same for English, and hence every language will have a grammatical system of its own; but as the laws of thought are always the same, there will always be a certain resemblance, more or less minute, between the grammars of all languages. As the result of the influence of Latin grammar on English, two negatives

occurring in the same clause, as is frequently the case in old writers, are considered as mutually destroying each other. So, at least grammarians said, and so custom declared, reversing in this case, the ordinary rule that custom makes grammar. This frequent occurrence of the double negative, was perhaps a remnant of the older form of the negative sentence. In A. S. the common negative is *ne*, which precedes the verb, as "Min tima ne com,"—"My time is not yet come." This 'ne' was often supplemented by some negative word after the verb. The usual one was *nawiht*, *naught=not=ne* a whit. As inflections diminished, 'do' was used to avoid ambiguity. In this case 'ne' preceded 'do,' and 'not' came between 'do' and the verb. This resembles the French *ne—pas=* "not a step," and *ne--point=* "not a jot," and the Latin *non=ne unum=* not one and *nonne*, where *ne* occurs twice over. This 'ne' in English was dropped, leaving us our present form of the negative, with 'do' first. Sometimes, however, 'do' also was omitted, giving us such expressions as "I beseech you that you *not* delay."

In questions, 'do' is used in all those cases where no other auxiliary is used. Its use thus probably arose from the desire to avoid ambiguity that might arise from placing a noun after a verb when case endings had been dropped, and punctuation was not generally used.

The accidents, or peculiar properties of verbs, are generally voice, mood, tense, number and person. Let us take a rapid view of the peculiarities of each of these. Nothing in grammar is more important than a knowledge of the true forms of the verb. This is peculiarly difficult in English; we must know the history of the word before we can speak with authority as to its construction.

With regard to voice, it may be said that the form called passive, has, in all

languages grown out of the reflexive form of the verb, this latter form being used in inflected languages as often in a passive sense as in a reflexive one. Reflexive verbs arose from the coalescence of the verb and the reflexive pronoun. In English we have no reflexive form for the verb, but the nature of a reflexive verb may be shown by an analysis of the two borrowed reflexives which we have, viz., *busk* and *bask*. These are Scandinavian.

Busk=*bua* (prepare) *sik*=self
Bask=*bad* (bathe) *sik*

Having no reflexive form, we consequently have no passive form, and are forced to periphrasis to supply it, using the substantative verb as an auxiliary, in association with the passive participle. It may not be out of place here to remark that this combination of verb and participle does not always constitute a passive tense, the participle being sometimes used as a mere adjective, as :

Every house is built by some man
 =a tense

The house is *built* of stone=*an* adjective.

This distinction is marked in German by the use of different verbs.

Personal endings are mere pronouns, that, being spoken rapidly after the verb, became coalesced with it. The only remnants of these left in English are *m* in *am*, *st* in the 2nd singular, and *s* and *th* in the 3rd singular. In derivation *m*=*mei*, *me*, *st*=*su*=*tu* (*t* being only euphonic), *s* is for *t* or *th*=*the*. Even these endings are omitted in the subjunctive mood. The loss of these endings arose from their inutility, as we always express the pronoun before the verb. The coalescence of verbs with pronouns is seen in such forms as *nelt*=*ne wilt*; *me not*=*me ne wot*, meaning one knows not, since the word *me* here is an old indefinite pronoun, meaning one. "It shall not be, so *theech*"=as I thrive.

Number is the change of form a verb undergoes, to show whether its subject is singular or plural. Formerly the plural was indicated by the termination *es* in the North of England, *en* in the middle, and *eth* in the South; this *en* was the last inflection that was dropped from our language; except in *are* and *were* the plural is now indicated only by the absence of endings.

Tense, or the mode of indicating the time of an action, is very important. By some, indeed, it is considered the chief function of the verb; hence the German name for verb is *Zeitwort*. We have naturally three sets of tenses, to correspond with the natural divisions of time. But we can allude to the time of an action as the time at which, and as the time during which. We can also refer to the action as finished, or unfinished. This gives us four modifications of each of the chief tenses, irrespective of the emphatic. Thus the verb *send* would be for the present tense—

indef. I send.	incomplete, am sending.	complete, have sent	continuous, have been sending.
	emphatic, I do send.		

These tenses are more or less definite, the simple tenses being probably less definite than the compound. The present tense is the most indefinite of all, being used to express any other time more frequently than the present. It is used to express what is actually going on, customary actions, general truths, past events and future actions. This last it has in English, in common with all Gothic languages, and is owing to the fact that these languages had no future tense, and were forced to use the present as such, or resort to periphrasis. This accounts for the frequent use of the present for the future, especially after conjunctions. For the past we use the present only in animated narrative. We could not now say, "Before Abraham I am."

The only tense forms we have in English are the present and past. The mode of forming the past from the present gives us the most interesting and important classification of the verb, viz: that which divides them into two classes, *strong* and *weak*. Strong verbs have only a change of vowel to indicate past tense; their past participles end in *en*, which, however, is frequently dropped.

The method of indicating past time by a simple play upon the vowels is a remarkable development of the Gothic languages, and compares favorably with any inflection. It seems to have originated in reduplication of the first syllable of the verb, a process common in all languages to indicate past time. Compare the latin *momordi* and *fafaci* = *fefeci* = *feci*, and the Gothic *hai* *hait* = *hight* = *called*, and our *dodo* = *dode* = *dide* = *did*. This would always give a modified vowel for the past, and as people readily grasp at analogies, the habit was ultimately made general of forming all past tenses by the same change. In this case *i* seems to have indicated the present, *a* the past, and *u* the participle. Alongside this ancient method there arose the inflected method, formed as all inflections are by adding a word to the verb, which became in time a mere inflection. This became the favorite method of conjugation, most verbs changing to it from the older, and at present it is the only one for new verbs. It is supposed that this appended verb was *did*, contracted afterwards into *dide* and *ede* and *ed*, and finally the *e* is dropped out in pronunciation, and often in spelling; even the *d* is often dropped, as in *let*, *set*, etc. When the ellipsis of the *e* brings the *d* into contact with the final consonant of the verb, if that consonant be *t*, *k*, *p* or *s*, we get a sharp and a flat consonant united, which cannot be sounded, we consequently are forced to give *d* its

sharp sound, or *t*. Sometimes this *t* is written, as in swept, wept, but more frequently the *d* is retained in spelling, as stepped, decked.

Milton and some of his contemporaries, and Tennyson in our own time, spell all these words with the *t* for the sake of the symmetry of the rhyming words; but as the advantage is slight, and as it increases the number of irregularities, and ignores the solemn style of pronunciation, it is probably not advisable to make this method general at present.

Owing to the growth of the weak method of conjugation, many verbs originally strong assumed the weak ending as well, such as tell, told. These might very appropriately be called mixed verbs. Others took some of their parts after the weak, but retained the old participle as flow, sow. This was probably owing to the adjective nature of the participle, as we find another class conjugated after the weak, but also retaining the old participle as an adjective, such are molten, cloven, stricken. So great was the tendency to make weak verbs during the transition period of our language, that many verbs were used as weak that have since asserted their strong forms: during the last century many writers attempted to make such verbs as blowed, clinged, frezzed, drawed, etc., but in this the nation has not sanctioned them.

The form of the past participle deserves some attention. The termination of the strong participle was *en*; that of the weak was *ed*; in both cases the ending was an adjective affix, denoting possession. The prefix was *ge*, afterwards changed into *i*, and finally dropped altogether. This *ge* is a preposition of similar significance to the Latin *cum*.

The formation of the compound tenses, where the participle is used, is not easily explained. Reasoning from the analogy afforded by other languages

and A. S., it is concluded that when *have* is used, as in "I have written a letter," the participle is in agreement with the object; but that when *is* is used, as in "he is arrived," the participle agrees with the subject. Hence of the two forms "has arrived" and "is arrived," the former is not historically correct, though it is the usual form, since "has" is the general auxiliary of tense now, while "is" is only rarely used as such. The form with 'is,' is said to refer more to the condition of the subject, that with 'has' to the action itself.

Mood. No quality of the verb has given rise to more discussion, or presents more difficulty, than mood. Its main feature seems to be to indicate the nature of the speaker's conception of the act. If we make a statement as a fact, we have the indicative; if, as a mere judgment of the mind, the subjunctive; if as a command, the imperative, and if the action is only named, and no assertion at all is made, the infinitive. For these four we have traces of inflection, but for no other. On the ground of inflection, then, we will have to discard the so-called, *potential* mood. Moreover, all the tenses of this mood may be explained separately, and are not uniform in meaning, sometimes asserting positively, at others conditionally, as in "He may come," subjunctive, since there is doubt, but "You may go now," a fact, hence the indicative. There is more difficulty, but also more accuracy in this way of treating verbs.

The infinitive is a noun in nature. In A. S., its ending was *an*; in O. E. *en*. The dative ending was *enne*, with *to* before the verb. When the *en* was dropped, *to* was used before the nominative, except in some few verbs, which yet omit it, these are the auxiliaries and some verbs of the tenses. Besides these two forms there is a third form in *ing*, which is simply the old infinitive ending *en*, confounded with the participial. With regard to words ending in

ing, it may be remarked that there were four endings merged into the modern ing. These were *ande* of the participle, *an* of the infinitive, *enne* of the dative infinitive, and *ung* of the verbal noun. This similarity of form in those different parts of speech gives us great difficulty in ascertaining the nature of the words. Their construction is the safest guide to their meaning. If they are simple nominatives they are nouns, or infinitives from *ing* or *en*; if governed by prepositions, and descriptive of acts, followed by cases, they are infinitives; if descriptive of purpose, they are gerundials.

To know the difference between a participle and an adjective, we should remember the nature of a verb, thus

A verb=assertion + time + attribute.

Participle=time + attribute.

Adjective=attribute.

In "a thinking man" we have a permanent quality, hence thinking is an adjective. In "man thinking" we have only a temporary attribute; hence thinking is participle. Walking-stick, walking is the gerund of purpose and could not be a participle unless a stick that walks is meant.

Lastly, we come to the *subjunctive* mood, the most difficult of all moods to master.

This mood is indicated by a different form for the substantive verb, and by the loss of personal endings in other verbs, but frequently we can only detect it by examining the nature of the thought. The use of *be* instead of *am*, *art*, *is*, arose perhaps from the idea of futurity contained in that verb. The compound forms of this mood were occasioned by the loss of inflections; thus *had*, when used with the meaning of "would have," is a remnant of the inflected subjunctive. If we remember that the subjunctive expresses not a fact, but something thought of, part of its difficulty will be removed. Hence if this *subjective* idea be kept in view

it will be found that we have the subjunctive expressing, 1st, a *wish*, as "Thy kingdom *come*;" 2nd, a *purpose*, as "See that all *be* in readiness;" 3rd, the purport of a command, as "Go bid thy mistress, that she strike upon the bell;" 4th, a supposition or wish contrary to fact, as "If he were here," "Oh that he were;" 5th, a concession, as "Though he *slay* me." It is an open question whether we have a subjunctive or an imperative in such expressions as the following:

"Good, now sit down and tell me, he that knows."

"Come we now."

If we are to be guided by similar forms in other languages, we would call these verbs imperatives, but as there is something incongruous in addressing a command to one absent, or to oneself, and as a strong wish is closely related to a command, we would be justified in calling these forms subjunctives of wish.

The subjunctive of *attraction* is a name intended to describe a peculiar subjunctive in dependent sentences, influenced by a previous verb, as in "He will lie, sir, with such volubility that you *would* think truth *were* a fool."

There is a distinction made with regard to the use of the indicative or the subjunctive after *if*. In this case, when doubt is present, use the subjunctive, as "If the prisoner *be* guilty" =doubt. "If the prisoner *is* guilty," =fact or opinion. Compare also the significant use of the subjunctive in Othello's exclamation. "I think my wife *be* honest, and I think she *is* not."

The student need not be told that the subj. forms are more frequently used in poetry than in prose, and that the tendency is growing to discard them altogether, and to throw the burden of indicating the peculiar idea meant upon the context and the connections.—A.

MATHEMATICS.

Solutions to the Problems in the January Number.

1. Draw a line longer than the width of the ruler; place the ruler across this line, inclining the end above the line to the right until the edges of the ruler pass through the ends of the line, and rule a line along the left edge; similarly, with the top to the left, rule along the right edge.

2. Proceed as above, only rule along both edges of the ruler. An isosceles triangle will thus be described on each side of the line, and the line joining their vertices will bisect the given line.

3. Let BAC be the ang.; lay an edge of the ruler along AB so that the other edge may cut AC and draw CD along the edge cutting AC in C; CD will be parallel to AB; similarly, draw BD parallel to AC; AD shall bisect the ang. BAC.

4. Take any two chords in the cir. not parallel; bisect each as in (3); the pt. where these bisecting lines meet is the cen.

5. By giving n the values 1, 2, 3, &c., we find that the spaces described in the successive intervals are as the Nos. 1, $2\frac{1}{2}$, $3\frac{1}{2}$, &c.; if, therefore, f be the accel. during the 1st interval the spaces described are $\frac{1}{2}f$, $\frac{5}{4}f$, $\frac{9}{8}f$, &c. Now, since the space in the 2nd interval is $\frac{5}{4}f$, and since f of this is due to the velocity acquired in the first interval, therefore the remaining $\frac{1}{4}f$ is due to the accel. in the 2nd interval; hence this accel. is $\frac{1}{4}f$. Similarly the accel. during the 3rd interval is $\frac{1}{4}f$, &c. If, then, the vel. acquired at the end of the 1st interval be v , there will be added to this in the second, third, &c., intervals, $\frac{1}{2}v$, $\frac{1}{2}v$, &c., respectively, so that the vel. finally becomes $(1 + \frac{1}{2} + \frac{1}{2} + \&c.)v$.

6. When the engine has gone 3 ft. its vel. is 30 ft. per sec.; but since the mass is now

increased to $\frac{3}{2}M$, the vel. is reduced to 20 ft. per sec., and the accel. to 100; therefore the vel. after passing over the next 3 ft. ($v^2 = u^2 + 2fs = 400 + 2 \times 100 \times 3 = 1000$), is $10\sqrt{10}$; the mass being now increased to $\frac{3}{4}M$, the vel. reduces to $6\frac{2}{3}\sqrt{10}$, and the accel. to $\frac{4}{7}$ of 150; hence the vel. after the next 3 ft. is $6\frac{2}{3}\sqrt{17}$; and since the mass is now increased to $1\frac{5}{8}M$, the vel. becomes $8\sqrt{17} = 33$ nearly.

7. After the lowest particle has fallen a ft., its vel. is $\sqrt{2ag}$; the mass is now increased to $2a$, and hence the vel. becomes $\frac{1}{2}\sqrt{2ag} = \sqrt{\left\{ ag \frac{(2-1)(2 \times 2-1)}{3 \times 2} \right\}}$; after falling a ft. farther the vel. acquired is $\sqrt{\frac{5}{2}ag}$, so that the third particle starts with a vel. $\sqrt{\frac{1}{9}ag} = \sqrt{\left\{ ag \frac{(3-1)(2 \cdot 3-1)}{3 \cdot 3} \right\}}$, etc; hence the vel. with which the n^{th} begins to move is $\sqrt{\left\{ ag \frac{(n-1)(2n-1)}{3n} \right\}}$.

$$8. \frac{a+b}{1-ab} = \frac{c+d}{cd-1}$$

$$\begin{aligned} \therefore acd + bcd - a - b &= c + d - abc - abd \\ \therefore acd + bcd + abc + abd &= a + b + c + d \\ \frac{a+b+c+d}{a+b+c+d} &= \frac{(a+b+c+d)abcd}{bcd+acd+abd+abc} \\ \therefore \frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d} &= \frac{(a+b+c+d)abcd}{bcd+acd+abd+abc} \\ &= \frac{a+b+c+d}{a+b+c+d} abcd = abcd. \end{aligned}$$

PROBLEMS.

9. If a slip of paper with parallel edges be tied in a common knot, and the edges drawn tight without crumpling, a regular pentagon will be formed.

10. A cistern is kept constantly supplied with water. Supposing that it is full at first,

it is found that 24 equal taps opened together will empty it in $5\frac{1}{2}$ min., and 15 of them will empty it in 13 min. How many will empty it in 33 min.?

11. If $\frac{a^2+b^2-c^2-d^2}{a-b+c-d} = \frac{a^2-b^2-c^2+d^2}{a+b+c+d}$

then will $\frac{ab-cd}{a-b+c-d} = \frac{ad-bc}{a-b-c+d}$

12. In what time will the discount on a sum of money be equal to the interest on the same sum for a year, money being worth 5 per cent. per annum?

13. Which of the following statements is more nearly correct?

$\frac{10}{9.009} = 1.11$ or $\frac{10}{1.11} = 9.009$.

14. A square plot of ground by a river's edge containing one-tenth of an acre is inclined at 30° to the horizon. If the river rises until the plot is just submerged, find the pressure on the plot.

15. Solve the eqns.

$\begin{pmatrix} x \\ -y \end{pmatrix} \begin{matrix} x+y \\ y^4 \end{matrix} = \frac{y^4}{x} \begin{matrix} x+y \\ y^4 x \end{matrix}$

16. The population of a country would increase annually 5 per cent., were it not that emigration annually carries off $\frac{1}{2}$ per cent. of the people; what will be the increase per cent. in the population after 5 years?

HONOR ALGEBRA,

JUNIOR MATRICULATION, 1879.

1. Define a fraction, and prove that

$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$

Simplify

$\frac{\frac{1}{1-a} - \frac{1}{1-b}}{\frac{1}{(1-a)b} - \frac{1}{(1-b)a}} \times \frac{\frac{1}{1-b} - \frac{1}{1-c}}{\frac{1}{(1-b)c} - \frac{1}{(1-c)b}} \times$

$\frac{\frac{1}{1-c} - \frac{1}{1-a}}{\frac{1}{(1-c)a} - \frac{1}{(1-a)c}}$. Ans, $-a^2 b^2 c^2$

2. Describe methods of finding G. C. M. of two algebraical quantities.

Shew that $(a-b)(b-c)(c-a)$ is the G.C.M. of $(a+b)(a-b)^3 + (b+c)(b-c)^3 + (c+a)(c-a)^3$ and $(a-b)(a+b)^2 + (b-c)(b+c)^2 + (c-a)(c+a)^2$

We can arrange the first expression thus:—
 $(a^2-b^2)(a^2+b^2-2ab) + (b^2-c^2)(b^2+c^2-2bc) + (c^2-a^2)(c^2+a^2-2ac) = -2a^3b + 2ab^3 - 2b^3c + 2bc^3 - 2c^3a + 2a^3c = 2(a-b)(b-c)(c-a)(a+b+c)$.

And the second expression can be arranged thus:—

$(a^2-b^2)(a+b) + (b^2-c^2)(b+c) + (c^2-a^2)(c+a) = -ab^2 + ba^2 - bc^2 + cb^2 - ca^2 + ac^2 = -(a-b)(b-c)(c-a)$. $\therefore (a-b)(b-c)(c-a)$ is the G. C. M., and $2(a-b)(b-c)(c-a)(a+b+c)$ is the L. C. M.

3. Find the square root and the fourth root of $x + x^{-1} - 4\sqrt{-1}(x^{\frac{1}{2}} - x^{-\frac{1}{2}}) - 6$.

If $x^4 + 2ax^3 + bx^2 + 2cx + d$ is a complete square, prove that

$a = \frac{c}{\sqrt{d}} = \frac{b-2\sqrt{d}}{a}$

The first expression can be arranged thus:

$x + \frac{1}{x} - 2 - 4\sqrt{-1}(x^{\frac{1}{2}} - x^{-\frac{1}{2}}) +$

$(2\sqrt{-1})^2 = (x^{\frac{1}{2}} - x^{-\frac{1}{2}})^2 - 4\sqrt{-1}$

$(x^{\frac{1}{2}} - x^{-\frac{1}{2}}) - (2\sqrt{-1})^2 =$

$(x^{\frac{1}{2}} - x^{-\frac{1}{2}} - 2\sqrt{-1})^2 = (x^{\frac{1}{2}} - \sqrt{-1}x^{-\frac{1}{2}})^4$

In the next expression if we extract the square root by the ordinary method, and, at the end of the operation, equate the coefs. of x and x^0 we shall have

$\frac{b-a^2}{2} = \sqrt{d}$ and $a(b-a^2) = 2c$

$\therefore a = \frac{b-2\sqrt{d}}{a} = \frac{c}{\sqrt{d}}$

4. Find the roots of the equation $ax^2 + bx + c = 0$.

What do the roots become when (1) $a = 0$, (2) $c = 0$; (3) $a = 0$ and $b = 0$?

Prove that a quadratic equation can have only two roots.

5. Solve the equations

(1) $\sqrt{2x} + \sqrt{3x} = \sqrt{5}$. Ans 25-10- $\sqrt{6}$.

(2) $\left\{ (x+l)^2 - a^2 \right\} \left\{ (x+l)^2 - b^2 \right\} = \left\{ (x+m)^2 - a^2 \right\} \left\{ (x+m)^2 - b^2 \right\}$

Sol. $(x+l)^4 - (a^2 + b^2)(x+l)^2 = (x+m)^4 - (a^2 + b^2)(x+m)^2$

$\therefore \left\{ (x+l)^2 - (x+m)^2 \right\} \left\{ (x+l)^2 + (x+m)^2 - (a^2 + b^2) \right\} = 0$

$\therefore (x+l)^2 + (x+m)^2 - (a^2 + b^2) = 0$ (1)
and $(x+l)^2 - (x+m)^2 = 0$ (2)

\therefore from (1) $x = \frac{-(l+m) \pm \sqrt{2lm + b^2 + a^2}}{2}$

from (2) $x = -\frac{1}{2}(l+m)$

(3) $\frac{1}{x-3} + \frac{3}{x+15} + \frac{1}{x+3} - \frac{5}{x+9} = 0$

Sol. $\frac{4x+6}{x^2+12x-45} - \frac{4x+6}{x^2+12x+27} = 0$

$\therefore \frac{1}{x^2+12x-45} - \frac{1}{x^2+12x+27} = 0$
 $\therefore x = \infty$

and $4x+6=0; \therefore x = -\frac{3}{2}$

(4) (1) $\frac{1}{x} + \frac{1}{z} = \frac{2}{y}$
(2) $x+z = \frac{1}{4y}$
(3) $x^2 - 2yz = \frac{1}{12}$

Sol.—From (1) $\frac{x+z}{xz} = \frac{2}{y}$

\therefore combining this with (2)

$xz = \frac{1}{8}$

and substituting in (2)

$y = \frac{2x}{8x^2+1}$

And substituting both of these last results in

(3) and multiplying up.

$96x^4 + 4x^2 - 7 = 0 \therefore x^2 = -\frac{7}{24}$ or $\frac{1}{4}$

from which, discarding the first value, we find $x = \pm \frac{1}{4}$ and $y = \pm \frac{1}{8}$.

6. Find the sum of n terms of an arithmetical series, having given the first term and the com. diff.

Find the sum of 32 terms of an A. P. whose 5th term is 20, and whose 21st term is 15.

Sol.—Let a be 1st term and b com. diff., then $20 = a + 4b; 15 = a + 20b. \therefore b = -\frac{5}{16}$ and $a = 21\frac{1}{4}$
 \therefore sum of 32 terms is 525.

7. Define an harmonic series, and shew how to insert m harmonic means between a and b .

If $a, 2b$ and c be in H. P., then will $a+c, a$ and $a-b$ be in G. P., and also will $a+c, c, c-b$.

Sol.—Since $a, 2b, c$ are in H. P., then

$b = \frac{ac}{a+c}$ \therefore (1) $ac - ba - bc + a^2 = a^2$

$\therefore -\sqrt{(a+c)(a-b)} = a$

\therefore (2) $ac - ba - bc + c^2 = c^2$

$\therefore -\sqrt{(a+c)(c-b)} = c$

8. Find the No. of combinations of n things taken v at a time, and prove that it is the same as the No. of combs. of n things taken $n-v$ at a time.

Prove that the No. of combs. of $2n$ things taken n at a time is

$\frac{2n \cdot 1 \cdot 3 \cdot 5 \dots (2n-1)}{1 \cdot 2 \cdot 3 \dots n}$

Sol.—The No. of combs. of $2n$ things taken n at a time is

$\frac{2n(2n-1) \dots (n+1)}{1 \cdot 2 \cdot 3 \dots n}$

that is $\frac{2n \cdot 2n-1 \cdot 2(n-1) \dots 4 \cdot 3 \cdot 2 \cdot 1}{1 \cdot 2 \cdot 3 \dots n \times 1 \cdot 2 \cdot 3 \dots n}$

that is, taking every second term in the numerator,

$\frac{1 \cdot 3 \cdot 5 \dots (2n-1) \times 2^n \times 1 \cdot 2 \cdot 3 \dots n}{1 \cdot 2 \cdot 3 \dots n \times 1 \cdot 2 \cdot 3 \dots n}$

9. Assuming the truth of the Binomial Theorem when the index is a whole number, prove it when the index is a positive fraction.

Write down the fifth term of $(2^3 - 2)^{-n}$

Prove that

$\sqrt[3]{\frac{1}{8}} = \frac{1}{2} + \frac{1}{3 \cdot 2^2} + \frac{1 \cdot 4}{1 \cdot 2 \cdot 3 \cdot 2^2} + \dots$

Sol.—The fifth term of $(2^3-2)^{-n}$ is

$$\frac{n(n+1)(n+2)(n+3)}{1 \cdot 2 \cdot 3 \cdot 4} 2^{-3n-12} 2^4$$

$$= \frac{n(n+1)(n+2)(n+3)}{1 \cdot 2 \cdot 3 \cdot 4} 2^{-3n-8}$$

$$\sqrt[3]{\frac{1}{8}} = 6, \sqrt[3]{\frac{1}{8}} = (2^3-2)^{-\frac{1}{3}}$$

$$= \frac{1}{2} + \frac{1}{3 \cdot 2^3} + \frac{1 \cdot 4}{1 \cdot 2 \cdot 3^2 \cdot 2^3} + \dots$$

10. Sum the series

(1) $\frac{1}{\sqrt{2}} - \frac{1}{3} + \frac{\sqrt{2}}{9} - \frac{2}{27} + \dots$ to infinity.

(2) $3+6+11+20+37 \dots$ to n terms.

Sol.—In (1) the com. ratio is $\frac{-\sqrt{2}}{3}$ \therefore the sum to infinity is

$$\frac{1}{1 + \frac{\sqrt{2}}{3}} = \frac{3}{\sqrt{2}(3+\sqrt{2})}$$

The second series may be arranged thus—
 $(1+2)+(2+2^2)+(3+2^3)+\dots$, thus it resolves itself into the two series

$1+2+3+4+\dots$, and $2+2^2+2^3+2^4+\dots$,

$$\therefore \text{sum is } \frac{n}{2} (1+n) + 2(2^n-1).$$

SOLUTIONS TO THE EXERCISES IN TODHUNTER'S EUCLID.

309. ABCD the quad., AD, BC meeting in P and AB, DC in Q; join RP, RQ, RC; then ang. CRQ, CBQ are tog. eq. two rt. ang.; also CRP, CDP; but CDP, CBQ are tog. eq. two rt. ang; hence CRP, CRQ eq. two rt. ang.

310. Describe a cir. about ABC; then evidently each of these bisecting lines also bisects the arc AB; hence ADBC is a quad. in a cir.

311. Draw DH tang. to cir. CDE cutting AB in H; then ang. HDE eq. DCE in alt. seg. eq. DAH; hence H is cen. of ABD.

312. The lines bisecting OA, OB, OC, OD at rt. ang. meet in the cens. of these cir. and evidently form a parallelogram.

313. Ang. DCE (eq. ang. DEC) eq. ang. EAC and ECA; but DCB eq. EAC (in alt. seg.); hence BCE eq. ACE.

314. F is the cen. of the cir. circumscribing ABC; and since the base BC and the vert. ang. BAC are const., therefore the cir. is const.; hence AF, its rad., is const.

315. Take O the middle pt. of BC; then the sq on AB eq. sqs. on AD, DB tog. with twice the rect. BD, DO eq sq. on AD, and rect. BD, DC eq. sq. on AD, and rect. AD, DE eq. rect. EA, AD; hence, &c.

316. E the pt. of contact, then the tang. at E makes with EC an ang. eq. to EAB, and with ED an ang. eq. to EBD; and their differences are eq.; hence AEB eq. DEC.

317. Describe a cir. passing through A, B and touching the given cir. at P, (Todhunter's Euclid, p. 299), P shall be the pt. reqd.

318. A the pt. where the lines meet. B the cen. of the given cir.; join AB cutting the cir. in C; in the cir. take D and E on opp. sides of AB, such that CD, CE each eq. half the reqd. seg.; apply No. 6, p. 296, (Todhunter's Euc.) to des. a cir. passing through D, E and touching one of the lines; this will evidently touch the other line and be the cir. reqd.

319. Let AD, BE, CF meet in G; then a cir. may be desc'd. about AFGD; hence the

- ang. FDG eq. FBG ; let OB cut FD in K , and draw OH perp. to BC ; then ang. BAC (eq. half BOC) eq. BOH , and ang. at H, E are rt. ang.; therefore ABE eq. OBH ; hence KDO eq. KBD ; to each add KDB , therefore ODB eq. KBD , and KDB eq. OKD ; but ODB is a rt. ang.; hence, &c.
320. $ABCD$ the sq.; take any pt. E on the cir. between A and B ; draw EFG perp. to AB meeting AB, DC in F, G ; then the sqs. on EA, EB, EC, ED are tog. eq. twice the sqs. on EF, FA, EG, GC , *i. e.* eq. twice the sqs. on AE, EC , eq. twice the sq. on AC .
- 321 and 323 follow at once from 189.
322. The cen. is where the diags. intersect.
326. The ang. CAD is a fifth of two rt. ang.; hence the arc CD is a fifth of the whole cir.; hence, &c.
327. Let AB be the given st. line, divide AB at the pt. C , so that the rect. AB, BC may be eq. the sq. on AC ; on AB construct an isos. triang. having each of its sides eq. AC .
328. Since AE eq. AD , therefore arc AE eq. arc ACD eq. two-fifths of the cir.; hence DE eq. one-fifth, eq. DC .
329. Ang. CAE eq. twice ang. CAD , eq. ABD ; hence, &c.
330. Let CA prod. meet the cir. in H and DC in F ; then ang. FHB eq. ang. FDB , eq. BAD ; and FCH eq. BCD , &c.
331. The ang. ECD eq. EAD , eq. CAD , eq. CDB , therefore CE is par. to BG , and CD, AE are par. by 219; hence, &c.
332. The triang. ADE is eq. to ABD in all respects.
333. Bisect the arc CD in K , then DK eq. DF ; also the ang. CKD, CAD are tog. eq. two rt. ang.; therefore CKD eq. twice CBD ; hence the cen. of the cir. about BCD must be on the arc CD , therefore, &c.
334. In the fig. of IV. 11, let BD, CE meet in L ; CE, DA in M , &c.; then the triang. CLD, DME , &c., are isos. and eq. in all respects, therefore the lines CL, LD, DM, ME , &c., are all eq.; hence the remainders LM , &c., are eq., and therefore the fig. is equilat., and since the ang. L, M , &c., are eq. it is also equiang.
335. $FCDE$ is a parallelogram, therefore AC eq. BE , eq. BF and CD , eq. BF and BA .
336. (1.) The pentagon is made up of the three triang. ABC, ACD, ADE , but ADE eq. ADQ , (if AC, BD , in fig. of IV. 11, meet in Q), so that three times ADE is less than the whole pentagon by QCD .
(2.) By taking the eq. triang. ADE, ADQ, ABC, BCD . it is seen that four times ADE exceeds the whole pentagon by BCQ .
337. Bisect each of the arcs cut off by the sides of the triang., &c.
338. The ang. will contain 24, 60 and 96 deg. respectively. In the fig. of IV. 10, describe on AB an equilat. triang. ABX , BX cutting AD in R , then ARX shall be the tri. reqd. For BAX is 60 deg., and BAR 36 deg.; hence, &c.
340. Let AB, BC, CD be three sides of an equilat. fig. inscribed in the cir. $ABCDE$, then because AB eq. CD the arc AB eq. the arc CD , to each add the arc AED ; then the whole arc $BAED$ eq. $AEDC$; hence the ang. BCD eq. ABC , &c.

MISCELLANEOUS PROBLEMS SOLVED.

1. To solve the eqns.

$$\frac{ax + by}{cz} = \frac{cz + ax}{by} = \frac{by + cz}{ax} = x + y + z$$

$$\text{Each fract.} = \frac{(ax+by) + (cz+ax) + (by+cz)}{cz + by + ax} = 2$$

$$\therefore ax + by = 2cz, \quad cz + ax = 2by, \quad by + cz = 2ax$$

whence $ax = by = cz$ and $x + y + z = 2$

$$\text{whence } x + \frac{a}{b}x + \frac{a}{c}x = 2$$

$$\therefore x = \frac{2bc}{ab + bc + ca}$$

(2) A dog pursues a hare. The hare gets a start of 50 of her own leaps. The hare makes 6 leaps while the dog makes 5, and 7 of the dog's leaps are equal to 9 of the hares. How many leaps will the hare make before she is caught? (*Humblin Smith's Alg.*, p. 161.)

Let $6x =$ No. leaps made by hare.
 $\therefore 5x =$ " " " " dog.

Let $9y =$ No. ft. in each leap of the dog.
 $\therefore 7y =$ " " " " " hare.

$\therefore 45xy =$ distance gone over by dog,
 and $42xy =$ " " " " hare.

$$\therefore 3xy = 50 \text{ leaps of the hare,} = 350y \text{ ft.}$$

$$\therefore 3x = 350. \quad \therefore 6x = 700. \text{—Ans.}$$

(3.) The difference between the true and the bank discount on a note of \$5,300, payable in 9 months, is \$18. Find the rate per cent.

$$\text{Let } \frac{1}{x} = \text{rate of int. for 9 mos. } \therefore \frac{1}{x+1} =$$

rate of dis'c.

$$\text{Then } \frac{1}{x} - \frac{1}{x+1} = \frac{1}{x} - \frac{1}{x+1} = \frac{18}{5300} = \frac{36}{10600}$$

$$= \frac{6}{100} - \frac{6}{106}, \therefore \frac{1}{x} - \frac{1}{100} = \frac{6}{106}$$

$$\therefore \text{rate per an.} = 8\%$$

CHRISTMAS EXAMINATIONS, 1879.

CHEMISTRY, SIXTH FORM.

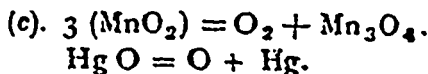
J. W. Spencer, B. A. Sc., Ph. D., F. G. S. } *Examiners.*
T. Mills, M. D., M. A.

I. (a). "Give best method for the preparation of O in the laboratory. (b). Give reasons for your answer. (c). Also indicate two other methods by equations."

(a). Heat Chlorate of Potash mixed with some Oxide of Manganese in a flask, and O will be given off. The Oxide of Manganese only facilitates the evolution of the O from the Chlorate of Potash; fine sand, etc., would have done as well; but if the O requires to be

absolutely pure, Chlorate of Potash alone must be used.

(b). This method is the best because it is the most convenient and economical.



II. (a). "Why is water hard? (b). What is the test for hard water? (c). How is Ca S O₄ detected in water, when in solution?"

(a). Water is hard because the Lime or Magnesia salts, which are held in solution in the water, unite with one of the constituents of soap to form an insoluble chemical compound which grates on the hands; hence (b) the test for hard water is that when soap is used in it, the soap does not form a lather, but curdles.

(c). CaSO_4 when dissolved in water is detected by means of Baric Chloride, which throws down a white precipitate.

III. (a). "Give proofs that the atmosphere is not a chemical compound. (b). State the ordinary impurities in air. (c). What objection to calling CO_2 an impurity?"

(a). 1. If O and N be brought together in certain proportions, no heat is evolved, hence the mixture cannot be a chemical compound, although it has all the properties of pure atmospheric air.

2. Air is soluble in water, as is also its components, O and N. But it is found that the air expelled by boiling, from water in which it has been dissolved, contains more than 20.8 per cent. of O. This is because O is more soluble than N, and the two gases dissolve in water in proportion to their individual solubility, hence the two components of air act as if they were in a free state, therefore we conclude that air is merely a mixture of O and N, and not a compound.

3. Potassic Pyrogallate absorbs free O. If air be confined in a tube over Mercury, and Potassic Pyrogallate be admitted, the Mercury will rise in the tube, as O is absorbed, to about one-fifth the space originally occupied by the air. This absorption of the O alone proves that it is not a chemical compound with N, because if any other gas in which O is a chemical constituent is treated in the same way, no action whatever takes place.

4. The gas Nitric Oxide which is colorless, has the power of uniting with free O to form Nitrogen Trioxide Acid, which is of a reddish brown color. Nitric Oxide does not take O from substances which have it chemically combined, but when it mixes with air it invariably

becomes red, proving that the O with which it unites is in a free state.

(b). The ordinary impurities of air are Carbonic Acid (CO_2), Aqueous Vapor and Ammonia.

(c). Objection might be made to calling CO_2 an impurity because it is necessary to the existence of plants, whose Chlorophyll in sunlight has the power of absorbing C from CO_2 and setting free O into the atmosphere.

IV. (a). "State the impurities of coal gas, and (b) how they are separated. (c). Why is C_2H_4 the more luminous, and CH_4 the more heating?"

(a). The impurities of coal gas are Ammonia, Carbonic Acid and Hydric Sulphide.

(b). The Ammonia may be completely separated by means of sawdust soaked in Hydric Sulphate; and forms the chief source of Sal Ammoniac.

The separation of Carbonic Acid is effected by absorbing it with lime.

Hydric Sulphide is disposed of by absorbing it with Ferric Hydrate; the sulphur of the former uniting with the iron of the latter to form Ferric Sulphide, while the remaining Hydrogen and Oxygen unite to form water.

(c). C_2H_4 contains a greater proportion of C than CH_4 , and as the brilliancy of the flame is due to fine particles of incandescent Carbon, the flame of burning C_2H_4 will be more luminous than that of CH_4 ; but, on the other hand, since CH_4 contains relatively more H than C_2H_4 , and that the intensity of heat is chiefly due to the presence of burning H, the flame of burning CH_4 will be hotter than that of C_2H_4 .

V. "The Acids HCl, HNO_3 and H_2SO_4 are poured into a tube. State the order in which they will arrange themselves, and explain."

If we take a litre of water and a litre H_2SO_4 it will be found that the H_2SO_4 is 1.842 times heavier than the water. In the same way HNO_3 is known to be 1.517, and

H Cl 1.2474 times heavier than water. Hence it will be seen, that as compared with the standard water, $H_2 S O_4$ is the heaviest, H N O_3 the next, and H Cl the lightest; and this is the order in which they will arrange themselves, $H_2 S O_4$ being at the bottom.

VI. (a). "Describe the manufacture of Hydric Sulphate ($H_2 S O_4$). (b). What impurities may it contain? (c). Account for their presence."

(a). Take a large glass bottle, and place in the bottom a thin layer of water. Arrange four tubes entering it near the bottom, and a waste pipe at the top. Through the first tube pass steam into the bottle. Through the second pass in Sulphuric Dioxide (made by burning sulphur). Heat a flask containing Copper turnings and Nitric Acid, to make Oxide of Nitrogen ($N_2 O_3$), which takes up an atom of Oxygen from the air, and becomes $N_2 O_3$ and allow this to enter by the third tube. The fourth tube is employed to admit, from time to time, a current of air. The action that takes place is this: when the $S O_2$ and $N_2 O_3$ come in contact, the latter readily gives up one-third of its O to the $S O_2$ to form $S O_3$; and this, uniting with the steam ($H_2 O$) forms $H_2 S O_4$ which is absorbed by the water in the bottom of the vessel. Now, the moment the $N_2 O_3$ gives up part of its O to the $S O_2$, the $N_2 O_2$ which is left unites with the O of the air, which is being admitted from time to time, to form $N_2 O_3$, which immediately hands over one-third of its O to the $S O_2$ to again form $S O_3$ and so the same operation is repeated *ad infinitum*, the ($N_2 O_2$) being merely the carrier of O from the air to the $S O_2$. The solution of $H_2 S O_4$ at the bottom of the vessel will be found to be very weak, but may be concentrated by evaporation.

(b). The impurities of commercial $H_2 S O_4$ are Lead, Arsenic and Nitric Acid.

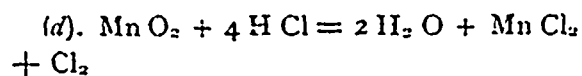
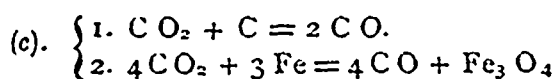
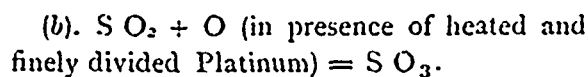
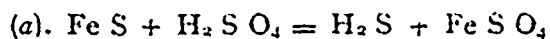
(c). The Lead comes from the leaden chambers in which the $H_2 S O_4$ is made.

The Arsenic, as an impurity of sulphur,

passes over with the $S O_2$ and mingles with the $H_2 S O_4$.

The Nitric Acid is owing to the presence of its constituents in the chamber where the $H_2 S O_4$ is made.

VII. "Give equations for the manufacture of (a) Hydric Sulphide, (b) Sulphuric Anhydride, (c) Carbonic Oxide, (d) Chlorine, (e) and explain its bleaching power."



(e). The bleaching of Chlorine depends on its strong affinity for Hydrogen. If we put a piece of *dry* litmus paper into a jar of dry Chlorine no action will take place; but, if we moisten the litmus paper, the Chlorine will immediately bleach it. The reason of this is that the Chlorine unites with the Hydrogen of the water and liberates in the fibres of the material the Oxygen, which, being in a nascent state, and hence possessed of intense combining power, unites with the vegetable coloring matter to form other compounds which are colorless.

VIII. "What volume of O is required to completely burn 10 litres of $H_2 S$, and how much of each product would be formed?"

5 litres of O are required to unite with the H, giving 10 litres of $H_2 O$; 10 litres of O are required to unite with the S, giving 10 litres of $S O_2$; in one equation—10 litres of $H_2 S + 15$ litres of O = 10 litres of $H_2 O + 10$ litres of $S O_2$

IX. "How much commercial $H_2 S O_4$ containing 80 per cent. of pure acid could be obtained by roasting 300 kilogr. of Pyrites ($Fe S_2$) in the air, when only 80 per cent. is given off?"

For every 5 $Fe S_2$ used we get 4 S_2 to enter

into the H_2SO_4 , that is, for every 5 ($56+64$) = 600 kilogr. used we get $64 \times 4 = 256$ kilogr. of Sulphur; \therefore from 300 kilogr. used we get $\frac{256}{2} = 128$ kilogr. of Sulphur to enter into the $H_2SO_4 = 2 + 32 + 64 = 98$; \therefore for every 32 kilogr. we have in 128 kilogr. Sulphur we have 98 kilogr. of pure Acid; \therefore we get $98 \times 4 = 392$ pure, and $\therefore \frac{5}{3}$ of 392 = 490 commercial Acid.

X. (a). "Explain the hypothesis accounting for allotropism of elementary bodies, together with experimental evidence of its truth. (b). Explain the use of the terms 'atom,' 'molecule,' 'compound radical,' and 'combining weight' as differing from 'atomic weight.'"

(a). Allotropism of elementary bodies is explained by supposing that the various forms of an element are caused by a different arrangement, or a different number, of atoms in the molecules of which it is made up. The truth of this may be seen in the case Ozone, which is an allotropic form of Oxygen. If a

current of electricity be passed through pure, dry Oxygen, it will condense to form Ozone, which is found to have 3 atoms to the molecule, whereas Oxygen has but 2.

(b). An 'atom' is the smallest portion of an element which can enter into chemical combination.

A 'molecule' is the smallest portion of an element or compound which can exist in a free state, and is generally composed of two or more atoms.

'Compound radical' is the name given to those groupes of elementary atoms which act collectively as elements.

The 'atomic weight' of an element is the ratio between the weight of a given volume of the element and that of the same volume of Hydrogen.

The 'combining weight' of an element is the fixed proportion by weight in which it is found to enter into chemical combination.

GEOGRAPHY.

The following is intended to supplement our text books on the Geography of the Dominion.

British Columbia is noted chiefly for its mineral wealth, its fisheries and timber products. The principal agricultural region lies south of the Thompson river. The mineral wealth is illimitable, but has not been developed for want of capital. Iron ore is especially abundant, and it is expected that the construction of the Pacific railroad will develop vast resources of gold and silver. The country is more mountainous than our geographies represent it to be. The railway will enter the province at Yellowhead Pass, descend the valley of the Thompson, and crossing the Fraser river, will have its ter-

minus at Burrard Inlet, north of New Westminster. The Rocky Mountains are gradually connected on the East with the vast prairies which stretch away South from the Mackenzie river, and include the country South of the Saskatchewan, Manitoba, Minnesota, Dakota, Iowa, Illinois, Missouri, Kansas, the Indian Territory and Texas. The 49th parallel of latitude is the boundary between Canada and United States in this part, and the prairie north of this is described as a vast extent of excellent farming land, the most fertile parts being the valleys of the Peace, Saskatchewan and Red River. Prof.

Macoun says that the country along the Peace River for 760 miles with a width of 150 miles on each side of the river, is as suitable for the production of grain as any part of Ontario. The climate and productions of this region resemble those of the country around Lake Erie. He was positive that the climate is uncommonly suited for agriculture. Coal of the best quality is found in abundance, especially near the Rocky Mountains, and in many places it is mixed with iron ore. The climate is affected by the "Chinook" winds from the South, and by the warm winds from the Pacific, which are not so much intercepted by the Rocky Mountains as they are farther south, because these mountains fall away in height towards the north. This is the richest part of Canada, and will no doubt soon be the home of a large population. The capital of the North-West is Battleford, on the N. Saskatchewan and Pac. R. R. line. It is 650 miles N. W. of Winnipeg, or 100 miles further away than Quebec is from Hamilton. In a few years these places will be connected by railway and by navigation. The only obstruction at present to the navigation is the Grand Rapids at the mouth of the Saskatchewan, and when these are overcome, vessels can sail from Edmonton on the Saskatchewan to Moorehead on the Red River, in Minnesota. It is even proposed to connect by a canal the Red River with the Mississippi, and thus open a water route to New Orleans. The distance from L. Winnipeg to Port Nelson, on Hudson Bay, is 301 miles, and the intervening country is flat, well timbered, and does not present very great obstacles to the building of a railway in that direction. The Assiniboine is navigable as far as Portage la Prairie.

The railway crosses the Red River at Selkirk below Winnipeg, and the distance to Thunder Bay is about 430 miles. This part will probably be finished before the end of this year. The

line west of Selkirk is more easily constructed. The Winnipeg River flows into L. Winnipeg; it is not navigable, since it has many rapids and cascades.

Manitoba extends 133 miles from east to west, and 104 from north to south. It has the richest alluvial soil on the continent; its climate is healthy; the winter is colder than in some parts of Ontario, but it is clear, dry and pleasant. On account of its dry atmosphere, the cold is not so much felt. The country around the lakes north of the province is generally covered with forest, and coal has been found in the south of the province, in the Pembina and the Riding Mountains, and along the Souris River. Manitoba is destined to be one of the finest stock-raising countries in the world; its boundless prairies covered with luxuriant grasses and its fine climate are among its peculiar advantages. It must be remembered, also, that wheat attains its best growth near its northern limit, because the colder climate develops the grain and not the stalk of the plant. The prairie extends about as far east as the Lake of the Woods, and beyond that lies the district of Keewatin. It is described as a land of lakes, forests and minerals.

The boundaries of Ontario as recently decided upon are as follows: R. St. Lawrence, Lake Ontario, R. Niagara, Lake Erie, R. Detroit, L. St. Clair, R. St. Clair, L. Huron, R. St. Mary, L. Superior, Pigeon River, Rainy Lake, Rainy River, 95th meridian, English River, L. St. Joseph, Albany River, James Bay, 79th meridian to L. Temiscanang and Ottawa River.

The following table of distances will be found useful.

Duluth to Quebec,	- -	1200 miles.
Quebec to Liverpool,	-	2600 "
Port Nelson to Liverpool,	-	2966 "
Montreal to	"	
by Strait of Belle Isle,	-	2790 "
by Cape Race,	- -	2990 "
New York to Liverpool,	-	3040 "

Yokohama to San Francisco	4470 miles	Hamilton to Montreal,	- 375 miles
San Francisco to New York,		" Quebec,	- 550 "
(air line),	- - - 2228 "	The following places have a mean summer temperature of 65° :—Boston, Portland, Quebec, Manitoulin Island, northern part of Manitoba, Peace River Valley, Yellowhead Pass, and Washington Territory. The following have a mean winter temperature of 15° :—St. of Belle Isle, Anticosti, Tadoussac, French River, Duluth, Pembina Prince Albert and the southern part of Alaska.	
San Francisco to Montreal,			
(air line),	- - - 2202 "		
Burrard Inlet to Montreal,	1992 "		
Yokohama to Burrard Inlet,	4374 "		
St. John's, Nfd, to Cape			
Clear,	- - - 1670 "		
Hamilton to Toronto,	- 40 "		
" Kingston,	- 180 "		

ADMISSION TO HIGH SCHOOLS.

DECEMBER EXAMINATIONS, 1879.

READING.

A passage selected from the first 246 pages of the Fourth Reader.—
Value 30 marks.

PENMANSHIP.

Sixteen lines of a piece of poetry selected from the Fourth Reader.—
Value 20 marks.

DICTATION.

TIME—TWENTY MINUTES.

Examiner—J. C. GLASHAN.

The Indian rose from his seat as if in extreme suffering. He passed and repassed me several times, and once pinched me on the side so violently that the pain nearly brought forth an exclamation of anger. I looked at him; his eye met mine, but his look was so forbidding that it struck a chill into the more nervous part of my sys-

tem. He again seated himself, drew his butcher-knife from its greasy scabbard, examined its edge as I would do that of a razor suspected dull, replaced it, and again taking his tomahawk from his back, filled the pipe of it with tobacco, and sent me expressive glances whenever our hostess chanced to have her back towards us.—*Fourth Book of Reading Lessons, page 129.*

VALUE 22. *Two marks off for each word mis-spelled.*

ARITHMETIC.

TIME—TWO HOURS.

Examiner—J. J. TILLEY.

Values

14

1. A man has 703 ac. 3 roods 22 sq. rods $14\frac{1}{4}$ sq. yds.; after selling 19 ac. 1 rood 30 sq. rods $2\frac{1}{4}$ sq. yds., among how many persons can he divide the remainder so that each person

Values	
	may receive 45 ac. 2 roods 20 sq. rods 25 sq. yards?
14	2. Find the price of digging a cellar 41 ft. 3 in. long, 24 ft. wide and 6 ft. deep, at 20 cents per cubic yard.
14	3. The fore wheel of a wagon is $10\frac{1}{2}$ ft. in circumference, and turns 440 times more than the hind wheel, which is $11\frac{2}{3}$ ft. in circumference; find the distance travelled over in feet.
14	4. $\frac{3\frac{3}{4} - 1\frac{1}{8} \text{ of } \frac{9}{16} + 8}{\frac{1}{12}(8\frac{1}{2} + 3\frac{3}{8} - 7\frac{7}{8} + 3\frac{3}{8})} \div \frac{.05 - .005}{.25 \div .5}$
14	5. Find the total cost of the following:— 2745 lbs. of wheat at \$1.20 per bush. 867 " oats " .35 " " 1936 " barley " .60 " " 1650 " hay " \$8.00 " ton. 2675 feet of lumber at \$10 per 1000 ft.
14	6. If, when wheat sells at 90 cents per bush., a 4 lb. loaf of bread sells for 10 cents, what should be the price of a 3 lb. loaf when wheat has advanced 45 cents in price?
16	7. At what price must I mark cloth which cost me \$2.40 per yard, so that after throwing off $\frac{1}{3}$ of the marked price I may sell it at $\frac{1}{2}$ more than the cost price?

ENGLISH GRAMMAR.

TIME—TWO HOURS.

Examiner—JAMES HUGHES.

Values	
6	1. Define--Comparative Degree, Conjunction, Gender,

Values	
	Participle, Relative Pronoun and Subjunctive Mood.
44	2. Parse—"The Spaniards employed coastguards to keep off interlopers, the commanders of which were instructed to massacre all their prisoners."
15	3. Analyze—"After the banquet, a shower of scented water scattered from invisible pipes, spread perfume over the apartment."
12	4. Correct the following, and give reasons for making the changes necessary:— (a). I am not sure but what it is right. (b). I will not go, except you promise to come too. (c). He is more cleverer than any one I ever seen.
13	5. Give the past participle of <i>go</i> , <i>have</i> , <i>lay</i> (to place) and <i>drink</i> ; the feminine of <i>earl</i> , <i>stag</i> and <i>miser</i> ; the plural of <i>medizum</i> , <i>madame</i> , <i>wharf</i> and <i>scarf</i> ; and the possessive plural of <i>mechanic</i> and <i>lady</i> .
10 i.e. 6+2 +2	6. (a). Give six rules for the use of capital letters. (b). Inflect <i>which</i> . (c). Inflect <i>to see</i> , in the future passive indicative.

COMPOSITION.

TIME—ONE HOUR AND A QUARTER.

Examiner—J. C. GLASHAN.

Values	
12	1. Make a simple sentence upon each of the following

Values

words:-Crocodile, flower, railway, Nelson, truth, temperance, chirp, tremble, conquer, besiege, fierce, candid.

3

2. Combine into a single sentence—A crow had seized a piece of cheese. It flew up into a high tree. It quietly prepared to enjoy its repast.

6, i.e.
2 × 3

3. Arrange each of the following sentences correctly:—

Wolsey left at his death many buildings which he had begun, in an unfinished state.

It is folly to pretend to protect ourselves against the accidents of life by heaping up treasures, which nothing can guard us against.

A romantic village was situated on the slope, composed often of a dozen neat cottages.

6, i.e.
3 × 2

4. Improve the following sentences by avoiding the repetition of related words:—

The abilities, as well as the virtues, of King Alfred justly entitled him to the title of the Great.

Wellington was anxious to be relieved from all anxiety in that quarter.

11, i.e.
8 + 3

5. Render into good English—

A fox was passing through a vineyard and so he saw some fine bunches of grapes on one of the trees; so he tried to reach one of them, but it hung very high and he could not get it.

Nothing is more effectual as a destroying agency, no means so sure as that of time.

Values

18

6. Combine the following sentences so as to form a connected narrative:—

Two young bears left their native woods. They came to a bee-hive. The bee-hive was well stored with honey. They were delighted with their discovery. They hastily overturned it. They began to eat voraciously. The bees were not to be deprived of the fruits of their labor with impunity. They flew about the bears. They stung them severely in the ears. They stung them severely in the eyes. The bears endeavored in vain to repel the attacks of their nimble foes. They were at last forced to retreat to the woods. They were maddened with the pain. They were blinded with rage. Their sufferings at last subsided. They had leisure to reflect upon their conduct. They lamented their folly. They resolved to profit by sad experience. Pleasure is often bought with pain.

16

7. Tell the following, in prose:—

In Grecian annals it remained untold,
But may be read in Eastern legend old,
How, when great Alexander died, he bade

That his two hands uncovered might be laid

Outside the bier, for men therewith to see—

Men who had seen him in his majesty —
That he had gone the common way of all,

And nothing now his own in death might call;

Nor of the treasures of two empires aught

Within those empty hands unto the grave had brought.

ENGLISH HISTORY.

TIME—ONE HOUR AND A HALF.

Examiner—S. ARTHUR MARLING, M. A.

Values

- | | |
|----|---|
| 12 | 1. Tell how the Roman conquest of England was brought about, and what were the principal changes effected by it in England? |
| 12 | 2. Why is the reign of King John a very important period of English History? Explain fully. |
| 12 | 3. Give an account of the public life of Oliver Cromwell. |
| 12 | 4. Tell what is meant by the Revolution, the Restoration, the Reformation, the Parliament. |
| 12 | 5. Why is the power of the Sovereign now less than it was three centuries ago? |
| 12 | 6. Tell the principal events of the reign of George III. |

GEOGRAPHY.

TIME—ONE HOUR AND A HALF.

Examiner—GEO. W. ROSS.

Values

- | | |
|----|--|
| 5 | 1. Define meridian, watershed, bay, frith and zone. |
| 12 | 2. What and where are Athabasca, Nelson, Chignecto, Restigouche, Gatineau, Temiscaming, St. Hyacinthe, Chesapeake, Quinte, Sacramento, Champ-lain and New Orleans? |

Values

- | | |
|----|---|
| 8 | 3. Where do you find the following natural productions in greatest abundance:—Cotton, copper, coal, coffee, tin, gold, furs and grapes? |
| 11 | 4. Say you embark at the Isle of Man on a voyage to the mouth of the Volga. Through what waters, and near what capes and islands would you pass? |
| 20 | 5. Draw a map of the coast of Asia from Behring's Straits to Cape Comorin, showing all the important physical features with their names neatly printed upon them. |
| 16 | 6. Locate the following:—Obi, Papua, Zambezi, Tunis, Morea, Cyprus, Venice, Lyons, Copenhagen, Borneo, Cheviot Hills, Crimea, Quito, Port-au-Prince, Trinidad and Luffoden. |

FOURTH BOOK AND SPELLING.

TIME—TWO HOURS.

Examiner—J. M. BUCHAN, M. A.

Values

- | | |
|----|--|
| 12 | 1. Tell what you know about the founding of English colonies in North America in the seventeenth century. |
| | 2. "They threw themselves at the feet of Columbus with feelings of self-condemnation mingled with reverence. They implored him to pardon their ignorance, incredulity, and in- |

Values	
	solence, which had created him so much unnecessary disquiet, and had so often obstructed the prosecution of his well-concerted plan; and passing, in the warmth of their admiration, from one extreme to another, they now pronounced the man whom they had so lately reviled and threatened to be a person inspired by Heaven with sagacity and fortitude more than human, in order to accomplish a design so far beyond the ideas and conception of all former ages." —ROBERTSON— <i>The discovery of America.</i>
4½	(i.) In what year was America discovered by Columbus? In whose service was he at the time, and how many vessels did he have with him?
1½	(ii.) What part of America did he first discover?
16½	(iii.) Explain the meaning in which 'implored,' 'incredulity,' 'prosecution,' 'well-concerted,' 'reviled,' 'inspired,' 'Heaven,' 'sagacity,' 'fortitude,' 'conception,' 'ages,' are used in the passage.
3	(iv.) <i>Created him so much unnecessary disquiet.</i> To what does this refer? What was 'his well-concerted plan'?
1½	(v.) <i>From one extreme to another</i> —What were the two extremes?
1½	(vi.) <i>More than human</i> —What is understood after 'human'?
3.	The Red Man came, The roaming hunter tribes, warlike and fierce,

Values	
	And the Mound-builders vanished from the earth. The solitude of centuries untold Has settled where they dwelt. The prairie-wolf Hunts in their meadows, and his fresh-dug den Yawns by my path. The gopher mines the ground Where stood their swarming cities. All is gone; All,—save the piles of earth that hold their bones, The platforms where they worshipped unknown gods, The barriers which they builded from the soil To keep the foe at bay, till o'er the walls The wild beleaguers broke, and, one by one, The strongholds of the plain were forced and heaped with corpses." BRYANT— <i>The Prairies.</i>
3	(i.) <i>The solitude of centuries untold.</i> —Explain the meaning of <i>untold</i> . Parse it.
6	(ii.) Explain the meaning in which 'yawn,' 'swarming,' 'beleaguers,' and 'forced,' are used in this passage.
4½	(iii.) What is meant by 'keep the foe at bay,' and 'the strongholds of the plain'? Who, according to Bryant, were the foe?
1	(iv.) What is the gopher?
5, i.e. 3+2	(v.) Point out the silent letters in— "The roaming hunter tribes, warlike and fierce ;" And in— "The platforms where they worshipped unknown gods." What final letter in the latter of these lines has a sound different from that which it usually has?
12	4. What is the difference in meaning between

Values	pine, the noun, and pine, the verb?
—	rue, " , and rue, "
	crew, " , and crew, "
	mean, " , and mean, "
	fare, " , and fare, "
	row, " , and row, "
	rail, " , and rail, "
	hail, " , and hail, "
	ward, " , and ward, "
	blow, " , and blow, "
	mow, " , and mow, "
	peer, " , and peer, "

One-third of the marks in each subject, one-half of the marks in parsing, and one-half of the whole number of marks were necessary to pass.

Ninety-six pupils passed from the Hamilton public schools, and the County of Wentworth.

TORONTO UNIVERSITY, 1876.

LATIN GRAMMAR.

QUES. 1. Give the gender of *acer*, *far*, *seges*, *ren*, *senio*, *dos*, *apex*, *bidens*; and mention peculiarities of inflection in *pecus*, *jugerum*, *equa*, *senatus*, *vis*, *frugi*, *Achilles*, *ancile*, *Sappho*, *hepar*, *semis*, *tigris*.

ANS. 1. *Ren*, *senio*, *apex*, and *bidens* are masculine; *seges* and *dos*, feminine; *acer* and *far*, neuter.

Pecus, Gen. *pecudis*, exception to nouns in *us*, in formation of the Gen.; *jugerum*, of the 2nd Decl., with the exception of the Gen. Plu., which is *jugerum*, of the 3rd Decl.

Equa, Dative and Ablative Plu. *equabus*, otherwise regular.

Senatus, regularly of the 4th Decl., sometimes the Gen. ending *i* of the 2nd.

Vis, Irreg. Plu. *vires*, *virium*, *viribus*, *vires*, *vires*, *viribus*.

Frugi, Irreg. in Comparison, *frugalior*, *frugalissimus*.

Achilles, sometimes takes the Greek endings; full declension as follows:—Gen. *Achillis*, *i*, Dat. *Achilli*, Acc. *Achillea*, em, en, Voc. *Achilles*, e, Abl. *Achille*.

Ancile, regularly of the 3rd. Decl., except Gen. Plu. *anciliorum* of the 2nd.

Sappho, Gen. *Sapphus*; other cases,

generally, the same as Nom.; the endings, *onis*, *oni*, &c., are rare.

Hepar, Irreg. in formation of the Gen. *hepatis*.

Semis and *tigris* are both irreg. in the formation of the Gen., *semissis*, *tigridis*; but *tigris* is also regular.

QUES. 2. Write the compounds where extant, of *lego*, *scando*, *habeo* and *rego*, with *con*, *pro*, *de* and *ex*; and conjugate them.

ANS. 2. *Colligo*, *egi*, *ectum*, 3; *cohibeo*, *ui*, *itum*, 2; *conscendo*, *i*, *sum*, 3; *corrigo*, *rexi*, *rectum*, 3; *prohibeo*, *ui*, *itum*, 2; *porrigo*, *rexi*, *rectum*, 3; *diligo*, *lexi*, *lectum*, 3 (from *lego*, collect); *delego*, *avi*, *atum*, 1, (from *lego*, choose); *descendo*, *di*, *sum*, 3; *dehabeo*, 2 (rare), *eligo*, *legi*, *lectum*, 3; *escendo*, *di*, *sum*, 3; *exhibeo*, *ui*, *itum*, 2; *erigo*, *rexi*, *rectum*, 3.

QUES. 3. Write a list of Archaic forms in Latin nouns and pronouns.

ANS. 3. (1). *As* for *ae* in the gen. of *familias*, although *familiae* does occur.

(2). *Ai* for the gen. ending *ae*; *aulai*, *aurai*, *pictai*, found in the poets.

(3). *Um* for *arum* in the following:—patronymics in *es* and *a*, several compounds in *cola* and *gena*, a few names of

nations *Aneadum, coelicolum, terrigenum, lapithum*, which occur in the poets, but *amphorum, drachmum*, are found even in prose.

(4). *Abus* for *is* in dat. and abl. plu. regularly so in *deabus, filiabus*; sometimes in *anima, liberta, nata, mula, equa, asina*.

DECLENSION II.

(1). *Erus* for *er*, found in *socerus* the old form of *socer*. In fact all nouns in *er, ir* and *ur*, in early Latin, terminated in *erus, irus, arus*.

(2). *I*, the original ending in the gen. of nouns in *ius* and *ium*, as *Appi, ingeni, imperi, consili, negoti*, now *ingenii, &c.*, but these are sometimes contracted into (old ending) *i*.

(3). *I* for *ie*, common in proper names in *ius*, as *Tulli, Virgili* for *Tullie, Virgilie*; also in *fili, geni*, for *filie, genie*.

(4). *Deus* in vocative is like nominative. In the poets the voc. is sometimes made like nom., in imitation of the Greek.

(5). *Um* for *orum*, common in words denoting *money, weight and measure*; *nummum, sestertium, cadum, talentum, &c.*, also a few other words, *deum, liberum, &c.*; *faber* and *socius* in certain combinations, as *praefectus fabrum* or *socium*; also *vir* in *duumvirum, decemvirum, &c.*

DECLENSION III.

(1). *Grus*, gen. *gruis*, which has the old ending *is, gru-is*.

(2). *Aes*, old dat. *aere*; dat. and abl. originally ended in *e* or *i*; this accounts for the nouns that take *i* in the abl., while the dat. now ends in *i*.

(3). *Im*, the ending of the old acc.; *navim, ravim*.

(4). *Eis* and *is*, endings of acc. plu.; *civīs*.

(5). *Is* and *ubus*, in dat. and abl. plu., *poematis, bubus*.

For Declensions IV., V., and the pronouns, see Harkness' Grammar, paragraphs 116, 4; 119, 4; 184, 5; 186, 3; 187, 1.

QUES. 4. Give the full Latin ex-

pression in words, and also in numerical signs, for 2,419,296.

ANS. 4. Bis decies centena millia, quadingena undevicena millia, ducenti nonaginta sex; CIIICCCCXIXCCXCVI.

QUES. 5. Give the imperative mood of *astipulor, patior, profiteor*, in full; also the perfect tense and supine of *adimo, cieo, fulcio, gigno, pario, saepio*.

ANS. 5. Pres. imper. *astipulare, astipulamini*; fut. *astipulator, astipulator, astipulantor*.

Patior,—pres. imp. *patere, patimini*; fut. *patitor, patitor, patiuntor*.

Profiteor,—pres. imp. *profiteri, profiteremini*; fut. *profitetor, profitetor, profitentur*.

Adimo, *ademi, ademptum*; *cieo*, *civi, citum*; *fulcio*, *fulsi, fultum*; *gigno*, *genui, genitum*; *pario*, *peperi, paritum*, and *partum*; *saepio*, *saepsi, saeptum*, generally contracted *sepsi, septum*.

QUES. 6. What cases do the following verbs respectively govern: *animadverto, exuo, egeo, irascor, minor, piget, tempero, moderor*? Distinguish different constructions with any of these.

ANS. 6. *Animadverto*, acc.; *exuo*, with acc. of person and abl. of thing, also accus. alone; *egeo*, abl. sometimes gen.; *irascor*, dat.; *minor*, acc. of thing, dat. of person, also dat. alone; *piget*, used impersonally, acc. of person feeling, gen. of what causes the feeling; *tempero* and *moderor*, with dat., are 'to moderate,' with accus., 'to govern.'

QUES. 7. Explain and illustrate the reflexive use of the passive voice.

ANS. 7. The Passive Voice is sometimes equivalent to the Active, with a reflexive pronoun, like the Greek Middle. In fact, the Latin has a middle voice, though not developed to the same extent as the Greek; *accingi*, to gird oneself; *mutari*, to change; *vertor, versor, volvor, plangor, &c.*

QUES. 8. Distinguish carefully between the use of the accusative and ablative, in expressing *space* and *time*.

ANS. 8. *Space*,—extent of space is expressed by accus. as *pedes octoginta*

distare; when expressed by abl. it may be classed as *Ablative of Difference*, as *millibus passuum sex consedit*. The ablative of distance must, in general, be regarded as an exception, although it occurs not only in later writers, but in Cæsar and Livy. *abest quinque millibus passuum*; but Cicero and others, in accordance with the rule, say *iter quinque, decem dierum or biduum triduum, or bidui tridui abest ab aliquo loco*.

Time.—In answer to the question *how long?* A noun expressing time is put in the accusative. A *point* or *space* of future time for which an arrangement is *now* made, is put in the acc. with *in*; the exact time at which a thing is to be done, acc. with *ad*.

Romulus *septem et triginta* regnavit annos.

Solvere *ad Graecas Kalendas*. Ad coenam Caniam invitatur *in posterum diem*.

In answer to the question *when? How long before? How long after?* by the abl.

Hibernis mensibus. *Paucis post mensibus*. *Paucis ante aëibus*.

In answer to the question *in what time?* a preposition is used, or the noun is put in the ablative.*

QUES. 9. Give the rules for *is* and *as* final, with the exceptions; and give exceptions to the rules (a) "All diphthongs are long," (b) "Every vowel before another vowel in the same word is pronounced short."

ANS. 9. The ending *is* is short; *as* is long. For exceptions see Grammar, 610, 1; 612, 623, 626.

QUES. 10. Distinguish, according to quantity, *quis, es, modo, malis, os*; and mark the quantity of *quin, fac, hic, dic, and nec*.

ANS. 10. *Quis*, 2nd Sing., Indic., Pres., of *queo*, also old form of *quibus*.

Quis, Interrogative pronoun.

ēs, 2nd Sing., Indic., Pres., and 2nd Sing., Imper., Pres., of *edo*, to eat; *ēs*, 2nd Sing., Indic., Pres., and 2nd Sing., Imper., Pres., of *sum*.

Mōdō, Dat. and Abl. Sing. of *Modus*; a measure; *mōdō*, adverb.

Mālīs, 2nd Sing., Subj., Pres., of *mālo*, I prefer, also Dat. and Abl. Plu. of *mālum*, an apple, *mālus*, apple tree.

Mālīs, Dat. and Abl. Plu. of *mālus*, a um.

ōs, mouth; *ōs*, a bone.

Quīn, fāc, hīc, pronoun, *hīc* adv. *dīc, nēc*.

QUES. 11. Translate the following sentences, and notice syntactical peculiarities:—

(a). Ego cur acquirere pauca Si possum, invidior?

(b). Quid mihi. Celsus agit?

(c). Invitum qui servat idem facit occidenti.

(d). Nihil istac opus est arte.

ANS. 11. (a). If I am able to acquire a little, why am I envied?

Invidio is used impersonally in the Passive.

(b). What is my Celsus doing? *Mihi*, Ethical Dative.

(c). He who saves a man against his will does the same as he who kills him.

Occidenti is a Graecism for *cum occidenti*, or more elegantly *ac occidens*.

(d). There is no need of that art.

Opus est takes the genitive of the thing. *Nihil* is an adverbial accusative.

QUES. 12. Explain and give examples of *Synesis, Anacoluthon, Hendiadys, Asyndeton, Aposiopesis*.

ANS. 12. *Synesis* is a construction according to sense without regard to grammatical forms, *Pars certare parati*.

Anacoluthon is a want of harmony in the construction of the different parts of a sentence, *si, ut dicunt, omnes Graecos esse*.

Hendiadys is the use of two nouns with a conjunction, instead of a noun with an adjective or genitive, *Armīs virisque* for *virīs armātīs*.

Asyndeton is an ellipsis of a conjunction, *Veni, vidi, vici*.

Aposiopesis, a breaking off in the

midst of a speech, *Quos ego—sed motos praestat componere.*

QUES. 13. Translate into Latin—

(1). Hannibal did wrong in wintering at Capua.

(2). The triumvirs distributed $37\frac{1}{2}$ acres to every man.

(3). He bought her a jewel for six million sesterces.

ANS. 13. (1). Hannibal Capuae hiberna agendo fecit errorem.

(2). Triumviri terna et septuncia jugera cuique distribuerunt.

(3). Gemmam illi sexagies sestertio emit.

* The strict distinction appears to be this : with the ablative we ask, *in* what time ; but with the accusative, *throughout* what time.

ENGLISH SOVEREIGNS SINCE THE CONQUEST.

First William, the Norman, then William, his son,
Henry, Stephen and Henry, then Richard and John ;
Next Henry, the third, Edwards—one, two and three,
And again after Richard, three Henrys we see.
Two Edwards, third Richard—if rightly I guess—
Two Henrys, sixth Edward, Queen Mary, Queen Bess ;
Then Jamie, the Scotchman, and Charles, whom they slew,
Yet after two Cromwells took Charles number two.
Then Jamie, the second, who stopped at no crime,
And William and Mary, who reigned at one time ;
Good Anne, Georges—four—fourth William all passed
And Victoria came, may she long be the last.

LINE OF KINGS SINCE THE CONQUEST.

Four Normans, from ten sixty-six, ruled o'er the land, till 'leven hundred and fifty-four.
Then followed the potent Plantagenet line—
Eight Sovereigns—it ended thirteen ninety-nine.
Lancaster and York proved a quarrelsome hive—
Six Sovereigns—it ended fourteen eighty-five.
The great House of Tudor next followed we see—

Five Sovereigns—it ended sixteen hundred and three.

James Stuart, sixth of Scotland, was first of his line ;

It broke with his son in sixteen forty-nine.

The Commonwealth lasted eleven years more, When the people were willing the Stuarts to restore.

The Stuarts, sixteen sixty, again ruled the state—

James, the last, was dethroned in sixteen eighty-eight.

The Orange-Stuart lines, double sovereigns is seen

To close with Queen Anne seventeen hundred fourteen.

The Brunswick or Hanover line, it's well-known,

Has had its six sovereigns, and still has the throne.

FORMATION OF CHARACTER.

If somebody should give me a diamond to carry to Europe, I can know exactly how much would be lost to the world were I to drop it into the sea ; but if a seed should be given me, I can only regard it with awe as containing concealed within it the food of untold generations. That is the difference between looking at the truth as a diamond or as a seed—as final or germinal.

In all training of character, continuity and economy must be supreme. The notion that character is spontaneous is held by most people in the earlier portion of their lives, and is wrong. When they discover this, nine-tenths change to the other extreme. This is wrong, too. Hosts of young men think that their character will form of itself, and that they will necessarily become better as they grow older. Hosts of old men believe that their character is fixed, and that it is impossible for them to become better. Such beliefs are foolish. The old failures cannot be thus transformed, but out of the old habits new can be formed. This is what many a poor creature needs to know. We must make what we are to be out of what we are already.—*Rev. Phillips Brooks.*

PAPER ON ENGLISH GRAMMAR.

Fifth Form, at the Christmas Examinations.

ANSWERED BY A. M. MACMECHAN, STUDENT OF THE COLL. INS.

I. (ã.) *Enumerate in order the historical sources of our vocabulary.* (b). *Classify words of Latin and French as to use.*

(a). The languages from which English is derived are Keltic, Latin, Anglo-Saxon, Danish, Norman-French and the modern languages.

(b). In English there are four classes of words derived from the Latin: 1st, Keltic-Latin, introduced during the Roman occupation of Britain. The words of this class are geographical terms and refer to military affairs or stations. 2nd, Saxon-Latin, so called from its being brought into the country by the missions of the Church of Rome to the Saxons. They are mostly words relating to the rites and doctrines of the Church. 3rd, Norman-Latin, introduced subsequent to the Norman Conquest. These are words used at the Universities and at Courts of Law. 4th, Modern-Latin, that is, Latin introduced since the revival of letters to the present day. These compose the largest class and relate to an infinite variety of subjects. They may be shortly classed as abstract terms.

There are two classes of words introduced from the French: 1st, those brought in at the Conquest. These show that the Normans were the ruling race, also their pursuits and condition in life. Titles of honor, words relating to the chase and to knighthood, and terms of law and refinement are in the main Norman-French words. 2nd, the French words introduced in modern times. These relate chiefly to cooking, fashion, war.

II. (a). *Estimate the merits of analytic and synthetic methods of expression.* (b). *Show in what respects the English have adopted or retained each, in Gender, Declension, Conjugation, Comparison and Syntax.* (c). *Show that they differ only in arrangement.*

(a). In the analytic method of expression the ideas are arranged in their natural order, that is, in the order in which they are conceived in the mind. In the synthetic, the words representing the ideas are skilfully placed so as to produce the greatest effect upon the mind. The former is the more natural method of expressing our thoughts, the latter the more artistic. The latter often has the advantage of conciseness of expression, the former that of clearness in meaning. A synthetic language is specially suited for poetry and the art of the orator, while an analytic is naturally adapted for the setting forth of mathematical and metaphysical truth.

(b). In Gender the English has retained from the Anglo-Saxon the synthetic method of denoting the Gender by terminations, the feminine from the masculine, as spins-ter and vix-en, (fox-en). The analytic method of forming the gender prevailed among the Saxons and is retained by us; indeed it is the only one now practicable. We see that it was a common method among the Saxons from the following example: man was the common term for both sexes, then weap-man (the fighting man) was the term to denote the masculine gender, and wif-man

(the weaving man, woman) the feminine. We have also adopted two Norman terminations to denote the feminine gender: "ess" and "ine," e. g., heroine, abbess.

In Declension the English has retained some synthetic forms from the Saxon, as the plural in "en," "ox-en," "children" and "es." Though we yet retain the synthetic Saxon genitive as our possessive singular, and have also transferred the "s" to the possessive plural, yet English is essentially an analytic language, and nearly all our case-relations are denoted by prepositions. As regards the plural in "s," we have both retained and adopted it, for "s" was the Norman plural and "as" the Saxon, and they blended so that it is impossible to distinguish them.

Our forms in Conjugation in the participles and gerunds and in the past tense of weak verbs are synthetic, and retained from the Anglo-Saxon; but our method of forming the compound tenses was adopted from the Normans and is analytic, that is, the words that modify the idea are placed before it.

In Comparison we have retained the synthetic method, that of terminations "er" and "est," and adopted the analytic by adverbs, more, most, etc.

(c). It can be shown that the analytic and synthetic methods of expression differ only in arrangement by taking examples from a representative inflected language, such as Latin, and an uninflected one, such as English. For example: *don av-er-o* equals I shall have given; *o* is the personal ending first person singular, equals I; *er* is the element that shows futurity, as in *ero* I will be; *av* is the part that shows the completeness of the action, (Eng., have; Ger., haben; Fr., avoir; Lat., habes); and *don* the root signifying give. So, piecing together the parts thus attained, we see that the analytic mode of expression differs from the

synthetic only in arrangement.

III. Trace the following through the periods of English: the plural, the infinitive and participle of the Verb; the Adjective; gender, number and case of the Noun.

The form for the plural indicative in Anglo-Saxon was "ath"; in Old English it became "en," and was changed over to the subjunctive; in Middle-English "en" was dropped, and plurals were alike in the first person.

In Anglo-Saxon the infinitive ended in "an" or "en"; then in Semi-Saxon they ended in "e," the "n" being dropped. In Old English the infinitive again ended in "an" or "en," but had "to" placed before it. In Middle-English the infinitive was expressed by "to" and "for to," and "en" was discarded. The gerundial infinitive in Anglo-Saxon ended in "enne"; this became, in Semi-Saxon, the "an" of the infinitive. In Old English "an" was dropped after "to," but in Middle-English it reappears in the gerundial or participial infinitive.

Participles in Anglo-Saxon were declined like adjectives, and terminated in "ende" and "ande"; in Old English they lose their declension and end in "ing." Finally, in Middle-English "ing" was regarded sometimes as a verbal noun ending, and sometimes as the termination of the gerundial infinitive. The perfect participles in Anglo-Saxon ended in "en," with the prefix "i" or "y," (German "ge.") In Semi-Saxon "en" was left out, and in Old-English the "i" or "y" is lost.

Adjectives in Anglo-Saxon had a declension and gender. They followed the noun and dropped all forms of gender and declension.

Gender, in Anglo-Saxon nouns, was marked by the ending of the nominative, and still more by the other endings of the cases. In Old-English, gender ceased to be marked in this

way, and at length followed the sex. In Anglo-Saxon there were certain characteristic feminine endings, as in "spins-ter" and "freond-inne." In Old-English these were dropped or remain as exceptional forms.

There were five cases in Anglo-Saxon: the Nominative, Genitive, Dative, Accusative and Ablative. In Semi-Saxon they became fewer in number, and the Ablative disappeared. Then, in Old-English, all the cases were expressed by prepositions, except in the Accusative. In Middle-English the Accusative ending ceased. The Genitive singular ending in Anglo-Saxon was "es"; in Old English it was not used after "of," and in Middle-English "s" was used as the genitive ending in all the declensions. The termination for the Dative singular in Anglo-Saxon was "e"; in Old-English the "e" appeared but was not pronounced, and in Middle-English it was lost altogether.

The Genitive plural was in "na" in Anglo-Saxon; it became "s" in Old English, and has so remained.

The Dative plural ended in "um," then changed to "on" in Semi-Saxon, and was gradually struck out in Middle-English.

The sign of the Anglo-Saxon plural was "an" or "as"; in Semi-Saxon these were used indiscriminately, and in Old-English and Middle-English the plurals in "s" ceased, and "s" (since the Norman plural ending was the same,) superseded all others.

IV. *Write a note on Comparison and Comparative Forms.*

Comparison expresses the idea of relation between two. In most languages of the Indo-European family there are two methods of Comparison: by terminations (pospositional) and by adverbs (prepositional). In all languages of this group the forms for expressing Comparison by means of terminations are nearly the same. In Greek the usual comparative termina-

tion is $\tau\epsilon\pi$; in Latin, "or" or "is"; in Anglo-Saxon, "or" and "re"; in English, "er."

Many words in English, now changed in meaning, are really comparative forms, such as "rather," from *rathe*, (A. S., early); "near," now a positive, is the comparative of *neah*, *nigh*; "farther" is the comparative of *far*, (A. S., *fewr*) *farrer*, and the strengthening "th" inserted, and "further" from *fore*, *forth*. There are other cases in which forms in "er" still retain the idea of duality, as "whether," "either." According to Bopp, the eminent German philologist, all forms that have the termination "er" involve the idea of quality.

V. *Write a note on tendencies in grammar.*

The leading tendency of language in general is to become analytic and monosyllabic; this is one of the most unvarying laws of the growth of language: the truth of this is shown in English by the dropping of inflexions in declension and conjugation, and by the extensive use of prepositions to supply their place, thus giving us what is called the analytic construction in contra-distinction to the construction by means of inflexions which is termed synthetic. That many of our words tend to become monosyllabic is proved by the fact that all monosyllables which have been formed from other words by radical change were originally formed from those words by means of terminations which changed the spelling of the word, and were then dropped as useless. The explanation of this dropping away of terminations is, that as inflexions became more and more corrupted, they were insufficient for accurate speech, and hence prepositions were employed to assist the different inflexions and explain their meaning; this only rendered the inflexions more meaningless, and in the course of time they were gradually dropped and their place supplied by the preposition.

This is the *chief* tendency of our language; but there are others such as the tendency of the meaning of all words to follow one of the five laws of *Expansion, Contraction, Amelioration, Deterioration* or *Metaphor*. There is also the tendency of words of foreign origin to assume an English form, as beef-eater for *buffetier*, sovereign for *sovran*.

In the verb the two most noticeable tendencies are (1) the Subjunctive Mood gradually dropping out of use, (2) and the tendency of many strong verbs to become weak, while few weak verbs tend to become strong.

English accent has also two very characteristic tendencies; (1) it always tends toward the beginning or radical part of words, as nature, theatre, &c.; (2) it tends to shift from a slight to a strong syllable, or to strengthen the slightly accented syllable by doubling the consonant or lengthening the vowel.

In spelling we notice that (1) when a short vowel stands alone there is a tendency to lengthen it, as sop, soup; Fr. son, Eng. sound; (2) when two short vowels come together with a slight consonant between them, there is a tendency to combine them in one syllable.

Besides all these there is the tendency, in composition, of the various parts of speech to have a fixed position in the sentence. This, it may be observed is the natural consequence of the gradual adoption of an analytic method of speech.

VI. Write a note on the terms *strong* and *weak* in grammar, and show the use of each form in the noun, the verb, and in derivation.

Strong and weak are, in grammar, terms applied to words to denote their particular manner of effecting a modification in meaning. The term "strong" is applied to those words that modify their meaning by some change *within*, that is, vowel-change; weak is applied

to words that modify their meaning by some change from *without*, that is, by the addition of terminations. We call nouns strong when they form the plural by some other means than by adding "s" or "es" to the singular; e. g; man, men; mouse, mice. These plurals were formed by the influence that the Saxon plural ending "er" had in modifying the root vowel of a word.

Verbs are called strong when they form their past tense and past participle irregularly that is in some other way than by adding "d" or "ed" to the present indicative. The theory for the formation of strong preterites is that the present was reduplicated in Saxon, after the analogy of other inflected languages, the root vowel modified and then the termination dropped in the due course of Phonetic Decay. The "en" of the past participle has been retained from the Saxon, but the sign "ge" has been dropped.

In derivation, strong is applied to words that are formed by the change of the root-vowel; as song from sing; and weak to those formed from roots by the addition of terminations as songster from song.

VII. (a). Enumerate the various methods of Word Formation; (b). and classify any two of them.

(a). There are five methods in language of forming words; 1st, by radical change; 2nd, by reduplication; 3rd, by composition; 4th, by inflexion; 5th, by terminations.

(b). Perhaps the two methods most usual and producing the greatest number of words are the 3rd and 5th; therefore we will classify them:—

Compound words may be produced by joining: 1st, two nouns, which may have (a) an oppositive relation, as "servant-man," (b) the genitive relation, as "iron-ship," (c) the dative relation, as "hat-band," (d) the accusative relation, as "time-keeper," (e) the ablative relation, as "steam-boat," (f) the locative relation, as "sea bridge"; 2nd,

an adjective and a noun, as "quick-silver"; 3rd, an adverb and a noun, as "after-thought"; 4th, a noun and an adjective, as "snow-white"; 5th, a noun and a verbal adjective, as "ox-eyed"; 6th, a noun and an active participle, as "heart-rending"; 7th, a noun and a passive participle, as "tempest-tossed"; 8th, an adverb and an adjective or participle, as "up-right," "out-spoken"; 9th, a verb and a noun, as "stop-gap"; 10th, a noun and a verb, as "ham-string."

By terminations we can express: 1st, the agent—the male or female agent, as "beggar," "barrister," "shepherd-ess"; 2nd, augmentation, as "cashier," "engineer"; 3rd, the object of an act, as "nominee," "employee"; 4th, an act, as "homage"; 5th, a state, as "freedom"; 6th, being or condition, as "vigilance," "marriage"; 7th, a quality, as "goodness"; 8th, place or office, as "granary," "bishopric"; 9th, diminution, as "satchel," "globule," "obelisk"; 10th, frequency, as "teamster," "poetaster"; 11th, descent, as "Johnson."

VII. *Mention the Affixes used to form agents, abstract nouns, diminutives, patronymics and collectives.*

The affixes used to form agents are: ar, ary, at, ive, en, ent, er, ess, et, etc, ian, ina, ine, ist, ix, or, rister. We form collective nouns by the terminations ry, ery, er; by the endings age, red, dom, y, ness, ship, th, er, ion, nde, ey, ty, tion, or, ism, abstract nouns are formed. Diminutives are formed by the following terminations: el, le, et, lock, ling, re, en, kin, cule, ule, ele, isk. Patronymics are formed by the suffixes, son, s, and ing, in English.

IX. *Write a note on the Alphabet, and account for our spelling, giving any rules you may know, with reasons and exceptions.*

If the English alphabet be tried according to the requisites of a perfect alphabet, namely: that every sound should have a sign, that no sign should

have more than one sound, and that similar sounds should have similar signs, it will indeed be found wanting. It is uncertain, one vowel, "a," has four sounds; it is inconsistent, "ch" for example, has no relation to "c" hard; it is erroneous, "th" as in "thine," is not connected with "t" at all, but with "d"; it is deficient, we have forty-two sounds in our language and only twenty-six signs; and it is redundant, for some signs represent two or more sounds, "c" hard is sounded "k," and soft, "s." The reason of this is seen from its history. Our present alphabet has taken its sounds from the Anglo-Saxon, and its signs from the Latin. It will be easily seen that such an arbitrary mode of suiting the signs to the sounds would make the alphabet very unsatisfactory.

The difficulties of English spelling may be accounted for in this way: our alphabet is deficient, the sounds of the letters are uncertain; we have taken our vocabulary from numerous sources, and we must show their derivation by their spelling; we must distinguish words alike in sound, but different in sense; the same words have come from the same roots through different channels, and these have different spelling, and it is difficult to decide which to adopt.

Rules for spelling (1) monosyllables in f, l, s, preceded by a short vowel, double the final letter; exceptions: gas, his, us, yes, if, of, clef. (2) Monosyllables ending in any letter than f, l, s, keep the final consonant single; exceptions: add, butt, buzz, ebb, egg, err, inn, odd. (3) Words in "e" mute generally retain it before additions that begin with a consonant, (a) and omit it before additions that begin with a vowel (b); exceptions: (a) awful, duly, truly, wholly, (b) "e" is retained after "v" and "a," and "c" or "g" soft, and before "ous" changes to "i." After "dg" e is generally omitted. (4) Final "y" in words

not compounds, (a) when preceded by a consonant, is generally changed into "i" (b) before additions, when preceded by a vowel it is generally retained (c) ; exceptions: (a) in compounds treated as such, y remains, as "hardy-work"; (b) before "ing" and "ism," y is retained, as "pitying" and words in "ie" drop "e" and change "i" into "y," as "die," "dying." (5). Monosyllables (a) and *English* verbs do not end in "c" but take "ck" for "c." Words of this ending from the classic languages are now spelt with c and without k; exceptions (a) lac, soc, zinc, talc, disc.

(6. Words ending in (a) double letter retain both before additions if these do not begin with the same letter (a) ; (a) If the same letter follows one is omitted as hilly; exceptions: words in ll generally drop one l before consonants; and some words in as drop "s" as bless. (7.) Words ending with

a double letter preserve it double in all derivatives formed by prefixes as feoff en-feoff; call, recall, (a) ; (a) enroll, befell, fulfill are sometimes spelt with a single l.

(8.) Monosyllables and words accented (a) on the last syllable, when preceded by a short vowel (b), double the final consonant (c) before a syllable that begins with a vowel; as thin-ner, acquit-tal. (a.) If the accent is *not* on the final syllable, the final consonant remains single, as offer; exceptions: appalled, cancelled, etc. If the accent is thrown back by the addition, from the final syllable, the final letter as refer, reference, exceptions, though if the word is classic, it follows the classic forms, irrespective, as inflame, inflammation. (b) If the vowel is long the consonant remains single, as toiling, (c) x final being a double letter (ks) is never doubled as mixing.

OCCASIONAL EXERCISES FOR THE SCHOOLROOM.

(Condensed from an Exchange.)

AMONG the "School Entertainments" of many schools may be found exercises not intended for public days, but which are both entertaining and profitable to the pupils themselves, because they awaken mental activity and give variety to the routine of school work. I remember the pleasure which some of us took in a simple exercise given by one of my early teachers. Several words were given to us, whose meanings seemed unrelated, and we were told to construct a good, reasonable sentence, embodying these words.

It gave us no new knowledge that I know of, but it did do something to awaken in us ingenuity and quickness of thought.

Of course the great value of the school work depends on the regular daily lessons, and much time cannot be given to exercises like this; but, although no one could live upon cake compounded wholly of spices, yet this furnishes no argument for the entire absence of spice in our cookery. Anything which makes the school agreeable and pleasant, if it is not out of harmony with the work of the

school, and pernicious to it, must be helpful.

In many schools it is customary to give one school session of each week, or each fortnight, to exercises of a varied character. Some of these call out the very best thought of many of our teachers. If they could be written out and published, other schools and other teachers could sometimes get great help from them.

In one school of my acquaintance, one of the hours of a "Wednesday afternoon" was profitably spent in writing telegraphic despatches. When written, they were read, and the teacher showed the scholars which were the best, because most concise and comprehensive.

In some of our upper village schools, it is possible to awaken thought and develop expression among the older pupils by school discussions. The ordinary school recitations give room for these, but sometimes it is not easy to take time enough for the recitation. The success of a discussion must depend largely on the subject which is chosen. That must be within the child's comprehension, and something in which he feels an interest. What kind of animal is the best pet, and why? Do we enjoy a pleasure most when looking forward to it, or when looking back upon it? What kinds of substances are suitable for our clothing, and what qualities make them suitable? Which are pleasanter, summer sports or winter sports? Which of my studies is the easiest, and why? Do we get more pleasure from seeing or hearing? Which is the more intelligent

animal, the horse or the dog? These, and questions like them, appeal to the experience of most school-children.

Suppose a class has just finished studying the geography of Canada, and that each child has been asked to select a city, and study about it, so that he can describe it. One of them begins: "I know a city in one of the Eastern Provinces. It is not on the sea coast, but is on a large river. If you were there you would see many ships and boats lying in the river, and on the wharves and near the river you would see a great many different kinds of merchandise." Here the class would begin to look intelligent, and as the pupil goes on to say: "you would probably see large quantities of lumber and grain, and perhaps hear some of the people speaking French." Nearly all the hands would be raised, and many voices would be ready to exclaim: "it is Montreal." Or, let each of the class select a short journey within the limits of Canada, and tell what he would be likely to see in taking a journey, showing on the map what route he would take, and describing all objects of interest. If some of the class can describe journeys that they have actually taken, the interest of the exercise will be increased. Or, ask each child to come prepared with a question beginning with "why." Why is there dew at evening? Why does smoke go up the chimney? Why is there snow in winter, but only rain in summer? When the questions are given, write them on the slate, and tell the children to think for a little while and see if they

can answer any of them. Those that are not answered at once may be left for the children to think of, or to ask their friends about; and at last, those that the children do not answer, the teacher may, if she can. But, if the teacher is often obliged to say that she cannot answer these questions, it will not harm the children to let them know that there are stores of knowledge which their teacher has not yet learned, or which human wisdom has not yet found out.

One of the pleasantest mental excitements that I have ever seen or tried with boys or girls from twelve to fifteen years old, is in the form of biography by question and answer. One of the children thinks of a character in history, with whom all are probably somewhat familiar, and the others are, in turn, allowed to ask questions, which he must, so far as he can, truthfully answer. "Is it a man or woman?" "A man." "Of modern or ancient times?" "Modern." "Of America or some other country?" "America." "Is he living?" "No." "Has he been long dead?" "Not very long." "Was he a General?" "No." "A Statesman?" "No." "A Writer?" "Yes." "Did he write poetry?" "No." "Did he write about science?" "Yes." "Was he a professor of something?" "Yes." Here the hands begin to come up, and some one asks, "Was it Agassiz?" "Yes."

The exercise may be among Bible characters. "Is it a man or a woman?" "A woman." "Does the Old or New Testament tell about her?" "The Old." "Was she a Queen?" "No."

"A Prophetess?" "No." "Did she live before or after King David's time?" "After." Here comes a pause for a moment. At last some one says, "did she live while Solomon was alive?" "Yes." "Was it the mother of the living baby that was brought before the King?" "Yes."

A similar exercise can be used as a geography lesson. Some one says: "I have thought of a City of Canada." "Is it in the Eastern or Western part?" "In the Eastern." "Is it a port?" "Yes." "Has it very much commerce?" "Not very much." "Is it noted for its history?" "Yes." "Is it a noted battle field?" "Yes." "Is it an old city?" "Yes." "Three Rivers?" "No, I told you it is a city, and Three Rivers is not a city." "Is it Quebec?" "Yes." I have known children to be so much interested by this that they would beg often to be allowed to play at "that game of question and answer."

Those to whom this number of the School Magazine is sent, will confer a favor by showing it to their friends, and as far as possible securing their co-operation in extending its circulation.

Any suggestions or assistance calculated to increase its usefulness, will be thankfully received.

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