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THE  
SCHOOL MAGAZINE

1880

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# THE SCHOOL MAGAZINE.

JANUARY, 1880.

## PROSPECTUS.

**O**WING to the rapidly increasing circulation of "THE QUARTERLY," and to the repeated demands of Teachers from different parts of the Province to issue it monthly instead of quarterly, the Publishers have decided to send to their Subscribers ten numbers a year instead of four. This new departure necessitates a change in the name of the periodical, which will henceforward be called "THE SCHOOL MAGAZINE."

Its chief aim is to supply a need, and this is its claim for public support. It is designed to meet a long felt want in the dissemination of a kind of information hitherto wholly neglected, or very inadequately supplied. Each number will contain matter suggested in the actual class-room work done during the month in the Hamilton Collegiate Institute and Hamilton Model and Public Schools.

The monthly issues will contain :

1. A series of mathematical problems (with difficulties solved), covering the whole of the Intermediate or Second Class work.

2. Difficult problems met with in examination papers for First Class

Teachers and for University Matriculation.

3. Solutions of problems taken from First and Second Class examination papers on Chemistry.

4. Answers to Questions in English set for First and Second Class Teachers and for Matriculation—pass and honors.

5. A series of notes on the authors, (English, French and Latin), prescribed for Intermediate or Second Class Examinations.

6. Answers to questions in Literature, prescribed for First, Second and Third Class Teachers and for Matriculation.

7. Answers to difficult Questions in Classics and Modern Languages at the various University Examinations.

8. A Public School Department, including notes on the work required for admission to High Schools and Collegiate Institutes.

The character of the work done in "THE QUARTERLY" will be some indication of what to expect in its successor, "THE SCHOOL MAGAZINE."

No pains or expense will be spared

in making it worthy of the support of Inspectors, Teachers and Students, and, as it enters upon a field of usefulness unoccupied as yet by any Canadian publication, its Publishers have confidence in asking the active assistance of Teachers and Students

throughout the country in extending its circulation and in advancing the objects its promoters have in view in publishing a Magazine of its practical character, knowing that they will meet with a hearty response.

### THE VERB.

THE verb being the exponent of judgment, the chief function of the mind, naturally assumes a very prominent place in language; hence it was very accurately named by the old grammarians, the *verbum*, or word of the sentence. It is the vital part of the sentence—the living word, as the Chinese call it, in contradistinction to the noun, which they call dead word. This term aptly described the verb in its peculiar character of adapting itself in form to express all the vast variety of thought, tense, person, number, etc. It is this peculiarity of the verb that throws such difficulty in the way of the student who attempts to analyze it; yet by its eminent use in language it is entitled to all the attention that can be bestowed upon it. To the philologist, the great tenacity of form exhibited by the verb, has been of the utmost service, presenting him with the embalmed forms of processes in language long forgotten, and affording the most conclusive proofs of the relationship of our language to other Gothic tongues. But our object now is grammatical discussion, and not philological, except so far as it may assist the former.

Every school-boy knows that 'to fight,' 'to mark,' and 'to yell,' are verbs, but he might not be able to tell wherein they differ from a fight, a mark and a yell. Now the first object of

investigation is to ascertain the essential characteristics of these verbs—what they have in common that distinguish them from all other words.

Language and thought are intimately connected, the former being the exponent of the latter. Thought consists of a comparison of ideas, consequently language will consist of words to represent these ideas, and to show their relations. These two classes of words are called respectively notional and relational, or presentive and symbolic. Notional words are of two kinds, 1st., those representing notions of existence or substantives, and 2nd, those representing notions of activity, or verbs. This is the only clear distinction between the verb and noun, when considered logically. A noun representing any object of thought, while a verb can only represent the notion of an action. The grammatical difference is much greater. Originally, however, a verb was simply a noun raised to a verbal power, without any change in form. Gradually the aid of pronunciation and orthography was sought to mark the distinction, until the two are separated very widely. Yet they have something in common—both have declension and number, but the verb has in addition conjugation, which is its chief distinction.

The essential quality of a verb, how-



ever, is not shown by its form, but when divested of all extraneous notions, every verb is found to consist originally of 'is,' and some attribute. as runs =is running. These attributes are not verbs, and the only common part is 'is,' *i. e.*, an assertion. All the rest can be expressed by adjectives, participles or adverbs—this excludes the infinitive, which, however, is not a verb, but a noun, as it neither makes an assertion nor marks time.

Having ascertained the essential of a verb, we are prepared to frame a definition of the term, for a definition must single out the quality that distinguishes the object described from all other objects. Grammatical terms were borrowed from logic. As logic treats of sentences, a logical definition of a verb would be "a word that is capable of forming the copula, or both copula and predicate of a proposition." Grammatical definitions may be of two sorts, as to function or as to meaning. Considered with regard to the latter mode, a verb may state what its subject *is*, or what its *attributes* are. This consequently gives us the old classification of substantive verbs and adjective verbs, meaning those that express simple existence, and those that express also some attribute—or, in the second place, a verb expresses what its subject *does*, what is done to it, and in what state it exists or acts. This necessarily gives us three varieties of verbs, *viz.*, active, passive and neuter, a classification which gives us the relation between subject and act. But it is sometimes necessary to specify the nature of the act as well. Some verbs, from the very nature of the action they express, require the notion of an object to complete their meaning, while others require no such supplementary idea. The terms transitive and intransitive are given to indicate this new quality, and combined with the others give us the terms active-transitive, active-intransitive, and passive verbs.

But active and passive are best considered as names of voices of a verb, and not descriptions of verbs. The nature of the object is also of importance, some verbs admitting two of a person, as "They elected him leader,"—him and leader are different names for the same individual before and after the choice, and are in apposition. In "I taught him music," him is evidently in an adverbial relation to taught, and as an object is not in apposition to music. In "Permit, I marshal you the way," there is some difficulty in ascertaining which is the object and which the modifier. There is another convenient classification of verbs, very useful for the purposes of analysis, into verbs of complete and incomplete predication—the latter term meaning that class of verbs that do not make a complete predicate, but require a supplement, either agreeing with the subject or with the object. An example may make this plain. "He is," or "we made him," has no meaning till we add some term to complete the sense, such as "to go," or "leader," or "happy."

There is a peculiar object found after intransitive verbs, whose office appears to be to add intensity to the meaning of the verb. It has been given the name "cognate object." It is adverbial in its nature. With regard to function, a verb is defined as "a word that makes an assertion." that being its chief duty in a sentence.

The origin of the verb was in the noun. At first the same in form, it gradually assumed new forms. By examining our verbal system, we can detect several modes by which words are made into verbs. The simplest change is by modifying the radical vowel, as "fall." 'to fell," "to lie," "to lay," where weak and transitive verbs have been formed from strong and intransitive verbs. As a supplement to the modes of changing nouns into verbs, already alluded

to, certain particles were early used to indicate a verb. Perhaps the most frequent of these is the "en," which is by some supposed to be simply the infinitive ending of the verb. The prefixes en, be, un, were and are still used to form verbs, though probably only the last is now used for new words. Other modes of verb formation are derived from foreign languages.

Before proceeding to the inflection of the verb, a few words about auxiliary verbs might not be out of place. These are a subordinate class of verbs, closely associated with their principal verbs, used to supply the place of the lost inflectional endings. They have all been gradually developed from principal verbs, and the peculiar difficulty and nicety of the use of some of them consist in the fact that they retain some of the meaning they had as principal verbs. Noticeably in this respect are shall, will, may, can, do, and let. Permit me here to cite a few examples of each of these, illustrative of its use, when in a transition stage between principal and auxiliary verbs.

*Do.* We have two principal verbs do—one a transitive verb, meaning to make, and the other an intransitive, meaning to thrive. We have both in the phrase, "How do you do?" The transitive do becomes an auxiliary, and has always been very extensively used as such. As an auxiliary it had formerly some trace of its transitive meaning, as in the following: "They have done her understonde."

*Let* had two meanings, to hinder, as in, "Sore let and hindered," and to cause, as "He let make Sir Ray seneschal of England."

*Will* is still used with its old meaning of volition, and forms those tenses of the future that represent the subject as intending.

*Shall, must* and *ought* all denoted obligation, and were used to denote an inevitable future—that which is destined, as witness the following: "You

shall offend him," where no command or threat is intended, but merely a statement of something that must necessarily follow. "It will please him, It shall please him." Here 'shall' is used to denote something like "is bound to."—"I will if I shall,"—"I am willing, if I must." In old prophecies the phrase "It shall come to pass," occurs as a mere future. This form is unusual with us, unless the prophet identifies himself with his prophecy, as in "Rome shall perish," a phrase involving a threat by the speaker.

*Shall* is now used as the word of command. This change probably originated in the reluctance of later writers to use a word of absolute necessity, like 'shall,' to or of a person; by them 'will' was used instead, thus 'will' acquired a new and indefinite meaning, while 'shall' assumed the meaning of compulsion. Where, however, from the nature of the subject, there can be no volition, but on the contrary a mere dependence on the inevitable course of events, 'shall' is used to denote the future of the 3rd person. Compare "What shall become of this?" with "What will this do for us?" In the first, 'shall' means 'is destined;' in the second 'will' is used, perhaps on account of the subject being in a sort of inferior personification, and capable of intending. Gray has "No more shall rouse them from their lowly bed," where 'shall' is in the third person plural, and means 'destined,' and has, of course, no reference to the speaker. Indeed, 'shall' is the proper word for the future, as in all languages the underlying idea of this tense is that of obligation and necessity; hence wherever 'shall' would not introduce ambiguity, it shall be used.

*May* and *Might* formerly meant physical ability, and numerous examples of their use in this sense may be found in the old writers. They are still used

so in poetry, which is tenacious of old forms and usages. Chaucer has "He was of grete elde and might not travaile,"—"He was of great age and could not work."

*Can* formerly meant "to have knowledge," and is of cognate origin with 'to con,' and 'ken.' It, however, early and easily acquired the meaning

of 'to have power.' The following shows its old meaning: "I know these Frenchmen, they *can* well on horseback."—*Hamlet*. From denoting physical power, and hence possibility, 'may' became a frequent auxiliary of the subjunctive mood, when that mood dropped its inflections, as, "It *may* rain," "*May* you be happy."

*To be Continued in next Number.*

LONDON UNIVERSITY MATRICULATION EXAMINATIONS,  
JUNE, 1870.

LATIN GRAMMAR AND COMPOSITION.

QUESTIONS.

1. Decline in the singular, *venter*, *tellus*, *gener*, *genus*, *servitus*, *lis*, *nux*, *dea*, *nurus*, *caro*, *domus*, *series*; and in the plural, *mel*, *nix*, *crus*, *imber*, *later*, *latus*, *carcer*, *lepus*, *pecus*, *nepos*, *litus*, *vis*.

2. Write down the Comparatives and Superlatives of *acer*, *celer*, *dives*, *gracilis*, *nequam*, *parvus*, *tenuis*, *bene*, *diu*, *prope*, *raro*, *vafre*.

3. From what verbs do the following participles come:—*Fisus*, *fissus*, *lapsus*, *mensus*, *nactus*, *nixus*, *orsus*, *pactus*, *ratus*, *refertus*, *tritus*, *vinctus*.

4. State what Cases are usually joined with the following Verbs and Adjectives:—*Ausculto*, *careo*, *caveo*, *consulo*, *induo*, *invideo*, *incedor*, *suadeo*, *studeo*, *avidus*, *dispar*, *idoneus*, *immunis*, *inops*, *tenax*.

5. Give examples in Latin of Defective, Frequentative and Desiderative Verbs.

6. The meanings of *erga*, *in*, *ob*, *prae*, *super*, *tenus*, with the cases which they govern.

7. *Hoc verum esse persuademur. Ire pollicitus est. Senatus edixit ut nemo urbe excederet. Sine gratia agenda nemo vivit bene.* Point out and correct the faults in the above sentences.

8. Translate into Latin:—

(1.) He came to see.

(2.) \*I heard he was weary of contending.

(3.) \*You use (*adhibeo*) an expression (*vox*) which is not becoming.

(4.) \*I shall not be allowed to come.

(5.) If *Regulus* had been willing to break (*fallo*) his word (*fides*) he would have escaped tortures and death.

(6.) He thinks that they will all be killed unless they return immediately.

(7.) He said there was no need of hurry.

(8.) This is to be done, [according as it expresses necessity or possibility.]

\*N. B.—In (2), (3) and (4) use an impersonal verb.

## ANSWERS.

1. Venter, ventris, ventri, ventrem, venter, ventre.

Tellus, telluris, telluri, tellurem, tellus, tellure.

Gener, generi, genero, generum, gener, genero.

Genus, generis, generi, genus, genus, genere.

Servitus, servitutis, servituti, servitutum, servitus, servitute.

Lis, litis, liti, litem, lis, lite.

Nux, nucis, nuci, nucem, nux, nuce.

Dea, deae, deae, deam, dea, dea.

Nurus, nurus, nurui, nurum, nurus, nuru.

Caro, carnis, carni, carnem, caro, carne.

Domus, domus domi, domui (domo), domum, domus, (domu) domo.

Series, — — — seriem, — serie.

Mella, — — — mella, mella, —

Nives, nivium, nivibus, nives, nives, nivibus.

Crura, crurum, cruribus, crura, crura, cruribus.

Imbres, imbrium, imbribus, imbres, imbres, imbribus.

Lateres, laterum, lateribus, lateres, lateres, lateribus.

Latera, lateram, lateribus, latera, latera, latera.

Carceres, carcerum, carceribus, carceres, carceres, carceribus.

Lepores, leporum, leporibus, lepores, lepores, leporibus.

Pecora, pecorum, pecoribus, pecora, pecora, pecoribus.

Pecudes, pecudum, pecudibus, pecudes, pecudes, pecudibus.

Nepotes, nepotum, nepotibus, nepotes, nepotes, nepotibus.

Litora, litorum, litoribus, litora, litora, litoribus.

Vires, virium, viribus, vires, vires, viribus.

2. Acer, acrior, acerrimus; celer, celerior, celerrimus; dives, divitior and ditior, divitissimus and ditissimus;

gracilis, gracilior, gracillimus; nequam, nequior, nequissimus; parvus, minor, minimu; tenuis, tenuior, tenuissimus; bene, melius, optime; diu, diutius, diutissime; prope, propius, proxime; raro, rarius, rarissime; vafre, vafrius, vaferrime

3. Fisis from fido; fissus from findo; lapsus from labor; mensus from metior; nactus from nanciscor; nixus from nitor; orsus from ordior; pactus from paciscor; ratus from reor; refer-tus from refercio; tritus from tero; victus from vincio.

4. Ausculto, Dative; careo, Ablative; caveo, Dative, to guard; Accusative, to guard against; consulo, Dative, consult one's interest; Accus., consult; induo, Accusative; invideo, Dative; (it may also have Accus. of thing grudged;) medeo, Dative; suadeo, Dative; studeo, Dative and Accus.; avidus, Genitive; dispar, Gen. or Dat.; idoneus, Dat.; immunis, Gen.; inops, Gen.; tenax, Gen.

5. Defective I. Conj. Mico are in— II. Conj. aceo, calleo, candeo, egeo, emineo, floreo, want the Supine; albo, aveo, caneo, calveo, flaveo, foeteo, want Perfect and Supine. III. Conj. angio, bibo, lambo, ningo, nuo, pŕuo, want Supine; clango, claudio, glisco, both Perfect and Supine. IV. Conj. sitio, vagio, want Supine; balbutio, ferio, gannio, tussio, both Perfect and Supine.

Examples of Frequentatives are canto, capto, dicto, clamito, habito.

Examples of Desideratives are Esurio, empturio, nupturio, parturio.

6. *Erga* is used with the Accus.— towards, against.

*In*, Accus. in answer to the question *whither?* Abl. in answer to the question *where?*

*Ob*, Accus. (a) for, instead of, in place of, (b) on account of, for the sake of.

*Prae*, Abl. (a) *before*, (b) in denoting comparison, *above* (c) through, by reason of.

*Super*, Accus. beyond; with the Abl. when it denotes, concerning, of, on, (of a subject of discourse.)

*Tenus*, Gen. and Abl.—as far as. up or down to. *Tenus* follows its case.

7. (a) Hoc verum esse nobis persuadetur. (b) Iturum se pollicitus est. (c) Senatus edixit ne quis urbe excederet. (d) Gratis non actis nemo vivit bene.

Explanation (a.) Persuadeo is intransitive, and must be used impersonally in the Passive. (b) Verbs signifying *hope, promise, undertake*, take the Fut. Inf. with the Accus. of the Pronoun. (c) In sentences, expressive of a *purpose*, if a negative follows *ut, ne* takes its place, and the affirmative pronoun or adverb is used.

(d) As the Abl. of the gerund is used

(1) Without a preposition, as an *Ablativus Instrumenti*.

(2) With the prepositions *ab, de, ex, in, pro*, (rarely,) and not with *sine*; the proper way of expressing *sine agenda gratia* is thus:—*gratus non actis*.

8. (1.) Venit ut videret.

(2.) Eum esse certamine fessum mihi auditum est.

(3.) Tibi adhibetur vox quae non est decora.

(4.) Mihi non licebit venire.

(5.) Si Regulus fidem fallere voluisset cruciatus et mortem fugisset.

(6.) Putat fore ut omnes interficiantur nisi extemplo redeant.

(7.) Negavit opus esse properato.

(8.) (a) Hoc faciendum est. (b) Hoc fieri potest.

ANSWERS TO QUESTIONS IN ENGLISH GRAMMAR AND ETYMOLOGY, FIRST-CLASS CERTIFICATES. JULY. 1875.

“The fault, dear Brutus, is not in our stars, But in ourselves, that we are underlings. Brutus and Caesar: What should be in that Caesar?”

Why should that name be sounded more than yours?

5 Write them together, yours is as fair a name;

Sound them, it does become the mouth as well;

Weigh them, it is as heavy; conjure with them,

Brutus will start a spirit as soon as Caesar. Now in the name of all the gods at once.

10 Upon what meat does this our Brutus feed That he has grown so great? Age, thou art shamed!

Rome, thou hast lost the breed of noble bloods!

When went there by an age since the great flood.

But it was famed with more than with one man?

15 When could they say, till now, that talked of Rome,

That her wide walks encompassed but one man?

Now it is Rome indeed and room enough, When there is in it but one only man.

O! you and I have heard our fathers say,

20 There was a Brutus once that would have brooked

The eternal devil to keep his state in Rome As easily as a king.”

*Shakespeare, Caesar, Act I, Sc. 2.*

1. Point out the subordinate sentences and explain their relations.

(a) “That we are underlings.” The construction is—“The fault that we are underlings, &c” Subs. sen., causal app. of ‘fault.’

(b) “Than yours (is sounded much).” Advl. of degree to ‘more.’

“Write them together,” “sound them,” &c. Imperative sentences equivalent to “If you write them.” “If you sound them.” &c -- conditional sentences.

(c) “As Caesar (will start a spirit soon.) Advl. of degree to ‘as.’

(d) "That he has grown so great." Advl of deg. result to feed="so that"

(e) "But it was famed," &c. = But it was famed with more men than it was famed with one man. The usual construction would omit the second 'with' whom one man (is) many. Adverbial of degree to 'more.'

(f) "That talked of Rome." Adj. to 'they.'

(g) "That her wide walks." Subj. object to 'say.'

(h) "When there is," &c. Advl. of time to 'is.'

(i) "(That) there was a Brutus. &c." Noun, obj. of 'say.'

(j) "That would have brooked" Adj. to 'Brutus.'

(k) "As (he would have brooked) a king (easily.\*)" Advl. of degree to 'as.'

2. Parse 'Brutus' in l. 3; 'now,' 'in,' 'at,' and 'once,' in line 9; 'great' in l. 11; 'there' and 'by,' in l. 13; 'now,' in l. 15; 'room,' and 'enough,' in l. 17; 'but,' and 'only,' in l. 18; 'fathers,' in l. 19; and 'king,' in l. 22.

'Brutus,' nom., or rather an independent element. 'Now' an expletive, with an illative force. 'In,' there is an ellipsis, the full sentence being "I ask in the name," &c. Supplying this verb would, however, render the sentences following noun sentences. To avoid this we may disregard the double relation of 'in.' 'At' shows the relation between some such word as 'taken,' or 'regarded' and 'once.' 'Once' adv. used as a noun. Obj. of 'at' 'great,' Adj. in the predicate, shows the quality of the object as seen after the act—or we may call 'great' a subjective complementary adjective to the verb of incomplete predication 'grown.' 'There,' an expletive. 'By,' adverb of place, direction, modifying, 'went.' 'Now,' adverb used as a noun, obj. of 'till.' 'Room,' pred. nom. after 'is.' 'Enough,' adj. qual. 'room' Supply the ellipsis and 'enough' must be passed as an adverb. 'But,' an adverb used to intensify the phrase (=only

one only, pleonastic.) 'Only,' parse in same manner. 'Fathers,' object of 'heard.' 'Fathers' and 'to say' are both accusatives. 'King,' object of 'would have brooked (understood.)'

3. Give the derivation of 'fault,' 'but,' 'that,' 'underling,' 'sound,' 'conjure,' 'spirit,' 'once,' 'age,' 'noble,' 'there,' 'fame,' 'than,' 'encompass,' 'indeed,' 'only,' and 'easily,' trace the history of the meaning where you can. 'Fault,' L. 'fallo' = to deceive, Fr. = faute. The French change 'f' of the Latin into 'u.' Among the poets the 'f' is sometimes mute, the word occasionally rhyming with 'thought,' 'sought,' &c. We get the 'au' from the French, but retain the sound of the Latin 'f.' 'But' from A. S. prefix, 'be,' the adv. 'ut' = out, 'an' = the Inf. ending. 'That' = the neuter of the A. S. demonstrative, se, seo, that. 'Underling,' formed from prep. 'under' and the diminutive 'ling' = el-ing. 'Sound' Latin, sono. Fr. sonner. From "striving after emphasis," 'o' becomes 'ou.' Note how the 'u' takes up the strengthening 'd.' 'Conjure' Latin 'conjuro,' 'con,' used intensively, and 'juro,' to swear. 'Spirit,' L. 'spiritus,' 'spiro' = to breathe, it being without a (material) body. 'Once,' genitive case of 'one' or 'an.' In this word we have the short sound of 'o' with the sound of 'w' preceding. 'Age' L. ævum, whence Fr. 'age'; A. S. 'eccc' everlasting. (Notice the consonantal change.) 'Noble' Fr. noble from L. 'nobilis' = well known from 'gnosco,' or 'nosco,' 'to know.' 'There,' A. S. dative of 'the.' 'Fame,' Greek, 'phemi' = to say, L. fama = good report. 'Than' Gothic, 'than' formerly 'then' acc. of that. 'Encompass' 'en' = in, 'con' = with ('u' changed to 'm' for euphony) 'passus' = a step, from 'pando' = to extend. 'Indeed' sometimes used synonymously with 'nay,' as 'I think, indeed, I am sure,' from 'in,' and 'deed' = something 'done.' 'Only' = 'onely,' 'ly' = 'like'; 'like one,' shows the old pronunciation.

'Easily,' A. S. as 'eath' and 'ly.' Fr. 'aise.'

4. Enumerate the meanings of 'dear,' 'fair,' 'sound,' 'become,' 'spirit,' and 'brook,' 'Dear,' 'costly'; 'attended with scarcity,' highly valued; beloved. A. S. 'derian'=to hurt, hence, hateful. "Would I had met my dearest foe in heaven."—Shakespeare. Dear to make dear. Diminutive, 'dearling,' 'darling.' 'Fair,' 'free from speck, spot or blemish'; 'White,' 'clear'; 'pleasing to the eye, and hence to mind; applied to weather, 'pleasant,' 'not specked, or spotted with clouds'; 'favorable,' 'as a fair wind'; affording hope; plain, obvious, 'not fraudulent,' candid, peaceful, just. 'pretty good' as a fair hand (writing.) 'Sound,' as a verb neuter, to make or emit a sound or noise. To appear by sound or on narration; to be conveyed in sound or report; (Law), to have an essential quality, as an action, as 'to sound in damages'; as a verb active, to cause to sound, to utter audibly, to direct or order or give notice by a sound, as 'to sound a retreat'; to celebrate or spread abroad by report, as 'sound his praise.' We have also noun 'sound,' adjective 'sound,' &c. (2) Sound from A. S. *gesund* healthy, etc. (3) Sound from A. S. *sund* a sound. 'Become' (A. S. 'becuman'=to happen or befall) to enter into some state or condition by a change from some other: (A. S. *cweman*, to please), to be suitable to.

'Spirit,' L. *spiro*, I breathe; breath; immaterial substance; soul; that which is apparent to sight but not otherwise perceptible; an apparition or ghost; constitution or disposition of mind with regard to the sensibilities; temper; intellectual constitution, power or strength of mind; intellectual perception, elevation or vehemence of mind; an emotion or activity of mind; a man of activity or energy; a person as characterized by particular qualities of mind or soul; characteristic quality or expression; vital or active principle;

nature, character; a mark to denote an aspiration; a term applied to all inflammable liquids, as brandy, &c.; (Theol.) The third person in the Trinity. Spirit, as a verb, to animate, &c.

'Brook,' (A. S. 'brucan,') to bear, to endure; 'brook,' as a noun, rivulet, &c.

5. 'But it was famed,' l. 14, change construction. "That more than one man did not fame," or "that was not made famous by more than one man."

6. Scan the first line of the extract: "The fault, dear Brutus, is not in our stars." Iambic Pentameter or Heroic measure; fourth foot a trochee.

7. Name the other plays of Shakespeare founded on subjects taken from Roman History. *Coriolanus*, and *Antony and Cleopatra*.

8. Some grammarians consider the article and the participle distinct parts of speech. State your own views with reasons.

The article really belongs to the class of adjectives. We have no more reason to regard 'the' as a separate part of speech than to regard the demonstrative 'that' as such. Each has a demonstrative force, such force being weaker in 'the' than in 'that.' They point out which thing or things we are speaking of, from a class of things denoted by a common noun. They are both forms of the old A. S. demonstrative 'se, seo, thæt,' 'the' being the uninflected form and also the ablative case. The name 'article' was appended to the words so-called from the fact of their being 'jointed on' to their nouns. The other demonstratives are used in the same manner. In the expression, "the black horse," 'the' points attention to the adjective 'black,' by which the horse in question is distinguished from others of the group to which it belongs. The adjective force is always present.

The so-called indefinite article 'an' is another form of the numerical 'one' (A. S. 'an,' Scotch 'ane,') and is in

reality a quantitative adjective. When placed before a noun, it indicates that we are speaking of *some one* of the things for each of which the noun is a name. "An" was used in A. S. as the indefinite article, thus "Mid anum croscearde," "with a potsherd Aelf," Hom. Its regular use in this manner was not established till after the Norman Conquest. 'Any' (from same root) is still more indefinite than 'one.' In 'a,' the 'n' is dropped for euphony.

The participle is really an adjective. It differs from the ordinary adjectives in this,—that the active participle can take a substantive after it as its object, (some ordinary adjectives, as 'worth,' 'like,' &c., govern the objective case). Even in the perfect tenses, as "I have written a letter," the original of the construction is "I have a letter written," where 'written' is an adjective agreeing with 'letter.' Cf. Latin, "Habeo epistolam scriptam;" French, "Les lettres que J'ai 'écrites." In A. S. the perfect participle in the perfect tenses was originally inflected, and made to agree with the object of the verb. In words ending in 'ing,' unless the meaning has an objective force, we must regard the word as an infinitive or noun. The participle is so called from partaking of the nature of both a *verb* and an *adjective*, and it is distinguished from the infinitive in this, that the latter has the force of a substantive, *i. e.*, it is the name of an action.

9. Discuss the grammar of these sentences:—

"O thou my voice inspire  
Who touched Isaiah's hallowed lips  
with fire."

'Who' is second person and agrees with 'thou;' hence 'touched' should be 'touchedst.' By poetic license the former may be sanctioned. "Ellipsis is when one or more words are wanting to complete the sense." Though this form of expression is used by good writers (see Angus' Grammar),

yet the sentence sounds badly, better, "Ellipsis is the omission of one or more words necessary to complete the sense." "Let us take care how we sin." 'How,' here used for 'lest,' imparts ambiguity to the expression; better, "Let us take care lest we sin." "This blunder is said actually to have occurred" Not 'said actually,' but 'to have occurred actually.' "This blunder is said to have actually occurred." "An example or two are sufficient to illustrate the general principle." In saying 'an example or two,' we really mean that more than one example is to be called into question. Usage would not sanction the singular verb. To arrive at a grammatical purism, we would be compelled to say, "One example is sufficient or two examples are sufficient," &c. "There is more than one fashionable dealer in old furniture, in the west of London, who habitually sells as old furniture, a greater part of which is new." 'More than one' is plural, hence 'are.' Sell what? Corrected—"There are more than one fashionable dealer in old furniture, in the west of London, who habitually sell as old furniture a greater part of which is new." (Notice the change in the position of the comma.)

10. "Orthographical expedients are resorted to on account of the imperfections of the English alphabet, which may be characterized as deficient, redundant and ambiguous."—*Authorised Spelling Book.*

Clearly explain the meaning of the term 'orthographical expedient,' and show in what respects the English alphabet is 'deficient, redundant and ambiguous.'

For a perfect alphabet, every simple sound should have a single sign, no sound should have more than one sign. Similar sounds should be represented by similar signs. Now, 'a' has four sounds, 'o' has three, 'e' two, &c., hence the deficiency



(forty-two elementary sounds are represented by twenty-six letters). 'C' is always k or s, j is represented by g, q is always kw, and x is a double letter, being equal to gs or ks, or it is a single letter with the sound of z, &c., hence redundance. 'G' may be hard or soft before i; the same letter is taken to represent more than one sound, &c.; the ambiguity is plain (see Angus, page 101, et seq.) To obviate the difficulties arising from these defects and inconsistencies of our alphabet, various means have been adopted. These plans may be denominated 'orthographical expedients.' Phonography is an attempt to remove the difficulties of our orthography;

and so far as a representation of the different sounds of our language by means of distinct letters is concerned, and of all allied sounds, it may succeed; but as the literature of our language is written in the old system, the 'orthographical expedients,' herein adopted, seem to be fixed; and this circumstance is one great barrier to the successful adoption of a phonographic system. A phonetic system by which our orthography would be corrected by using the present letters of the alphabet more consistently, without adding new letters or combinations that might tend to conceal the etymology and history of words, seems to be the most commendable.

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### GOLDSMITH.

**A**N exhaustive treatise on the life and labors of Goldsmith is not intended to be presented to our readers in the following pages. We propose to direct attention to some of the principal points to be noted in the consideration of his work and literary epoch. For fuller details the reader can refer to Foster's excellent *Life*, or to the more recent work by Black. A brief sketch of his life may first fitly engage our attention.

Oliver Goldsmith, the son of a Protestant clergyman, was born at the village of Pallas, in the county of Longford, Ireland, on the 10th November, 1728. Two years afterwards his father moved to Lissoy, in Westmeath, a village which has been identified with the *Auburn* of the *Deserted Village*. At school, Goldsmith did not distinguish himself; he was considered "a stupid, heavy blockhead," and he had no graces of person to

make amends for his seeming deficiencies in intellect. He was, however, gifted with a cheerful temperament and a large stock of animal spirits, which afterwards supported him in many a trying ordeal. He became an undergraduate of Trinity College, Dublin, in 1745. Shortly after this, his father died, and he became largely dependent on his uncle Contarine for means of support. He is said to have occasionally earned a small pittance by writing street-ballads at five shillings apiece. As may well be imagined, Goldsmith was far from being an exemplary student. After a somewhat chequered career he graduated in 1749, at the age of twenty-one.

The next difficulty was the choice of a profession. The Church was first selected, but for some reason, shrouded in mystery, Bishop Elphin refused Goldsmith's application. He tried teaching next, but he quarrelled with

his patron, and had once more to decide what to adopt to gain his livelihood. He appears now to have entertained the idea of emigrating to America, and he actually set out for Cork with that object in view, but, through some untoward accident, he was prevented from sailing, and lost his passage money in the bargain. Law was next tried and speedily abandoned. Medicine was the next profession for which he expressed a preference, and accordingly left Ireland in 1752, to prosecute his medical studies at Edinburgh, where he spent about two years. He next spent a year in Leyden. In 1755 he set out, flute in hand, with a solitary guinea in his pocket, to make the grand tour of Europe. Very little is known of his wanderings in Europe. He had made considerable progress in the formation of his peculiarly felicitous style, as evinced by a few of his letters written at this time. He returned to London in 1756, bringing back with him a medical degree and a larger acquaintance with men and things. Now followed some of the darkest years of his life. He eked out a precarious livelihood by acting at one time as a school usher, at another time by working in a chemist's shop, then by correcting proofs in Mr. Samuel Richardson's printing establishment, but chiefly by his labors as a literary hack. Griffiths, the book-seller, engaged him to do work for his magazine, at a salary which was certainly small enough for the severe and constant employment given him, but the hardest stipulation of all was that his work was to be reviewed by Mrs. Griffiths. He quarrelled with Griffiths before long, and supported himself by writing for the other periodicals of the day, and henceforth devoted himself entirely to literature.

It is unnecessary to give minute details respecting his after career in London. Although he made almost

fabulous sums by his works, he was never able to keep out of financial embarrassment. He was the most improvident of men; ready to give his money away at every tale of distress, whether true or false, or to spend it in the most reckless extravagance. His life, accordingly, was of a most up-and-down character, at one time on the verge of being imprisoned for debt, at another resplendent in "Tyrian bloom, satin grain and garter, blue silk breeches." He died in 1774, and in debt to the amount of two thousand pounds. He was fortunate in his friends. He was one of the original members of the famous Literary Club, of which Reynolds had the honor of being the first promoter; some of the other members were Dr. Johnson, Burke, Hawkins, Beauclerk, Garrick, Langton and Dr. Nugent. He was also acquainted with Hogarth. These names were the foremost then in England in the arts and literature, and Goldsmith could not fail to be much benefitted by intercourse with minds of such a superior order. Dr. Johnson, the critic and moralist; Reynolds, the first president of the Royal Academy, whose lectures on art are still highly prized; Burke, great as an orator, statesman and author; Garrick, the foremost actor of the day, each would, no doubt, exercise considerable influence in the development of Goldsmith's genius. It is especially interesting here to notice the association between the other fine arts and literature, a greater regard for beauty of form and color, a deeper interest in nature would be evoked by this association, and accordingly we find that Goldsmith is one of the precursors of the poetry of natural description.

We may now refer to those productions which have secured immortal fame to Goldsmith. Some men appear to be greater than their work, as Dr. Johnson the last king of English letters; other men like Goldsmith are not ap-

preciated so much as their productions. Goldsmith is usually said to have been a very poor conversationalist, a defect which, perhaps, has been somewhat exaggerated, and struck by the contrast between his blundering and insipid prattle, and the excellence of his literary work. Walpole professed to regard Goldsmith as an inspired idiot.

As an essayist, Goldsmith first rose into public favor, and in this department he proved himself a worthy follower of Addison, though, without reaching the eminence of that master. His chief works are *the Enquiry into the State of Polite Learning in Europe*, published in 1789, and *the Citizen of the World*, composed of letters written in the character of a Chinese Mandarin, who had come to investigate European manners and customs; the charm of these letters is found in the subtle satire with which certain phases of civilization, that appear incongruous even to a European, are treated, and the disguise is therefore very apparent. Goldsmith has been hastily identified with the man in black, mentioned in these letters, but this is an unsafe conclusion, as a writer of fiction has necessarily to utilize much of his own personal experience, and Goldsmith's experience was not the most extensive, as evidenced by the frequent recurrence in his prose and verse of the same thoughts and images. Prof. Masson writes in his *memoir of Goldsmith*, "That of these simple elements he made so many charming combinations really differing from each other, and all, though suggested by fact, yet hung so sweetly in an ideal air, proved what an artist he was, and was better than much that is commonly called invention. In short, if there is a sameness of effect in Goldsmith's writings, it is because they consist of poetry and truth, humour and pathos from his own life, and the supply from such a life as his was not inexhaustible."

As a novelist, Goldsmith can scarcely

be assigned a high rank, yet to him is due the credit of having produced the first genuine novel of domestic life, the *Vicar of Wakefield*, published in 1776, though written some five years previously. The interest which this tale excites is certainly not to be attributed to the plot or the skill with which the mere story has been constructed. We have already seen that Goldsmith has been credited with being a blunderer in conversation, and this appears to cling to him to a certain extent when he takes up the pen. We meet with incongruities upon almost every page of this work. The most extraordinary coincidences and improbabilities take place without a word of explanation. A few of these may be pointed out. The very title of the work appears to be a misnomer; the vicar leaves Wakefield shortly after the story opens, and it is never afterwards mentioned. The surprise of the vicar on learning that his old friend Wilmot is not a monogamist, although he was then courting his fourth wife, and the fact that Sir William Thornhill, well-known to his tenants and highly esteemed by them, is made to spend months in familiar intercourse with them under the assumed name of Burchell, without being recognized, all these are circumstances that detract from the story considered merely as such. Our delight in the work arises from the delineation of character and of that quiet domestic life from which so large a proportion of their happiness is derived by the inhabitants of the British Isles. The secret of its peculiar charm is somewhat difficult to state. No one who has read the work can fail to appreciate the characters of the good Vicar and his family, who are all hit off to the life. The air of truthfulness and simplicity which Goldsmith threw over the work is, no doubt, one of the sources of its power. No inconsiderable share of the pleasure it affords is to be attributed to Goldsmith's own

peculiar temperament, the qualities of his head and heart. This statement may seem, to a certain extent, to be a truism, but we must remember that Goldsmith drew largely upon his stores of personal experience, and consequently that he has infused much of himself in his work. We can discern much of his natural kindliness of manner, sly humor and delicate pathos, in the *Vicar* himself. Part, also, of its charm is due to his inimitable style, pellucid, fresh, sparkling, carefully adapted to the thought to be expressed, and heightened in many passages by poetic touches. Goethe has spoken gratefully of the pleasure afforded him by the *Vicar of Wakefield*, and declared it to be one of the best novels ever written, and ever regarded it as a real picture of English life.

Goldsmith enjoyed a high reputation as an historian in his own day—a reputation due to his polished and graceful style, rather than to any of the other qualities we attribute to the historian. He was not sufficiently industrious to enter upon that laborious research to which an historian must resort in order to verify his facts, and of what is denominated the philosophy of history, Goldsmith knew little, and for which he very probably cared less. His historical works are short sketches, mere abridgments of the currently received literature of the day on the subject, and from the charm of their style and their conciseness, they have been used as text-books until very recently. He has written the histories of *Greece*, *Rome* and *England*. Johnson's opinion of his *History of Rome* is interesting: "Goldsmith's abridgment is better than that of Lucius Florus or Eutropius, and I will venture to say, that if you compare him with Vertot in the same place of the Roman History, you will find that he excels Vertot. Sir, he has the art of compiling and of saying everything he has to say in a pleasing manner."

Goldsmith was a master in the art of condensation—in the knack of selecting everything most important to retain. His great defect was, that he knew nothing accurately, and his credulity made it an easy matter to impose on him. He was nearly hoaxed into giving, in his *History of Greece*, an account of a battle between Alexander, the Great, and Montezuma. In his *History of England* he states that Naseby is in Yorkshire! Perhaps his most extraordinary performance is his *History of Animated Nature*. On hearing of this projected history, Dr. Johnson remarked: "If he can tell a horse from a cow, that is the extent of his knowledge of Zoology." Yet the Doctor, though he thus notices Goldsmith's extraordinary ignorance of facts, was of the opinion that the *History of Animated Nature* would be "as entertaining as a Persian tale." And entertaining the *History* turned out to be, with its stories of gigantic Patagonians, nightingales that remember and repeat long conversations, and monkeys that preach sermons. We learn also, that the "insidious tiger" is a denizen of Canadian backwoods.

As a poet, Goldsmith must be regarded as having attained a very high position. His poems are *The Traveller* or *Prospect of Society*, *The Deserted Village*, *The Hermit* and *Retaliation*, with a few minor pieces. Macaulay has remarked that Goldsmith's works are defective in design, but happy in their execution, with the exception of *The Traveller*, where the plan surpasses the execution, felicitous though that be. We have an allusion in *The Traveller* to one of his pet theories, viz: that the accumulation of wealth is inimical to a country's real welfare, a theory which he makes the text of his *Deserted Village*. Hales remarks, "In accordance with the dubious theory of his age, he attempted what was called didactic poetry. Both *The Traveller* and the *Deserted Village*

have a didactic purpose. So far as that purpose predominates, they fail as poems, if not also as philosophical treatises. But, happily, Goldsmith's practice was better than his theory. Moved by a true poetic instinct, he often forgets his text; he intermits his preaching or his argumentation, and turns his powers to properer uses." The chief defect in *The Deserted Village* is one that has been frequently referred to. It is the location of such a village as Auburn, in its state of prosperity, in Ireland. Macaulay has noticed this incongruity, and said: that Goldsmith must have taken his description of Auburn in prosperity from some English village, that no Irish village of that day would present such a picture of felicity.

In dealing with this objection, Mr. Black has finely observed that "One of the radical facts of human nature—the magnifying delight of the mind in what is long remembered and remote," would account for the rustic beauty with which Goldsmith has invested *Auburn*. "The grown up Goldsmith had not to go to any Kentish village for a model; the familiar scenes of his youth, regarded with all the wistfulness and longing of an exile, became glorified enough." Granted that the explanation given by Mr. Black is the true one, that the poet regarded the village as endowed with charms, which were largely drawn from his imagination; yet it does not, we think, weaken Macaulay's objection. Mr. Black has explained why this description may have seemed true to the poet himself, but it is not on that account true to everybody else. It is manifest to all that the picture is greatly heightened; that such a village was not to be seen in Ireland in Goldsmith's time, and that notwithstanding Mr. Black's ingenious defence, the charge of incongruity still holds good. It is unnecessary to refer in detail to *The Hermit* and *Retaliation*, the former has been

regarded as a model in ballad writing, and the latter contains much acute discernment and description of the characters of the various members of the celebrated Literary Club. Goldsmith occupying, as he does, the transition period between the highly artificial age of Pope, and that of the romantic school, at the beginning of the present century, partakes of the qualities of both. He has preserved the same scrupulous regard for neatness of form, terseness of expression and melody of diction that marks the former period, and he exhibits the love of nature that characterizes the latter. His verse differs from that of Pope, by the greater spirit of earnestness it displays, by the less philosophical, but more serious consideration of the great problem of life. It is also to be noticed that he has not the same subtlety of thought and diction that mark some of the later writers; a subtlety that has been gained in a great measure from the study of metaphysics—a science that has been developed since Goldsmith's day. His verse is chiefly remarkable for its ease, grace and power to reach the heart—a power derived partly from the subjects treated of, and partly from the choiceness of his language. The subjects are such as affect all; the love of home, of country, reminiscences of boyhood or of travel, and a few simple passions are thus brought into play. His language also requires to be carefully noted. He excites our deepest emotions, our liveliest appreciation of the beautiful, not by ponderous words of sesquipedalian length and thunderous sound—the vice of a preceding age—but largely by words of Anglo-Saxon origin, many of them monosyllabic, and that appeal directly to the heart. No other writer, perhaps, exhibits the harmony that should exist between thought and its expression better than Goldsmith.

Goldsmith in his own day enjoyed

a reputation as a dramatist, little inferior to that he had as a poet. To him is due the credit of having revolutionized the comic drama for the better. Before his comedies of *The Good-natured Man* and *She Stoops to Conquer* appeared, a certain languishing sentimentality pervaded the comic drama. More tears, it is said, were shed at the comedies of that time, than at some of the tragedies. Black remarks that "He hated sentimentalists and all their works, and determined to keep his new comedy faithful to nature, whether the people called it low or not. His object was to raise a genuine hearty laugh; not to write a piece for school declamation." It is needless to say that he succeeded in the object and his best drama, *She Stoops to Conquer*, is as popular as ever on the English stage.

We regret that want of space will not permit us to notice his drama at a greater length, nor have we time to notice his *Biography of Beau Nash*, one that secured to the subject more fame than he deserved. We may conclude by giving Dr. Johnson's opinion, "Goldsmith was a man of such variety of powers and such felicity of performance, that he seemed to excel in whatever he attempted; a man who had the art of being minute without tediousness and generally without confusion: whose language was capacious without exuberance: exact without restraint; and easy without weakness;" and by this sentence from his celebrated epitaph, "Oliver Goldsmith, a poet, a natural philosopher, and an historian, who has left no species of writing untouched by his pen, nor touched any that he did not embellish; whether smiles or tears were to be excited, he was a powerful, yet gentle, master over the affections: of a genius at once sublime, lively and equal to every subject; in expression, at once lofty, elegant and graceful."

## NOTES ON EDUCATION.

Health is never at any period of life so precious as in the first years. Then it is confirmed or destroyed, made or unmade. For children under seven the whole teaching that should be naturally conveyed should be through play, if the body is to be trained up healthy as the bearer of the mind, and it is wonderful what an amount of learning can by this method be attained. Letters of language can be taught; conversation in different languages can be carried on; animal life can be classified; the surface of the earth can be made clear; history can be told as a story, and a number of other and most useful truths can be instilled, without even forcing the child to touch a book or read a formal lesson. Under such a system the child grows into knowledge, makes his own inventory of the world that surrounds him and the things that are upon it, and, growing up free to learn, learns well, and eats, and sleeps and plays well. In a child trained after this method, not only is health set forth, but happiness likewise—a most important item in this period of life.—*Dr. Richardson.*

Under the high pressure of our public schools I frankly confess that I take the little children's side in all their little plots to stay away from school a day, when they have been hard at work for many days. If they will be frank and bring the matter before the home tribunal, they can always be sure of one advocate who will plead their cause with a moving eloquence rooted in old memories of half-holidays that are written in letters of gold.—*Robert Collyer.*

Knowledge acquired merely with a view to examination or recitation, is usually very shallow and imperfect, and soon passes out of the mind when the occasion that prompted the effort is passed.—*Dr. Whewell.*

MATHEMATICS.

PROBLEM PAPER JUNIOR MATRICULATION, 1879.

Solved by G. Ross, Mathematical Scholar, Toronto University.)

1. An A.P., a G.P., and an H.P. have each the same first and last terms, and the same number of terms ( $n$ ), and the  $r$ th terms are  $a_j, b_j, c_j$ ; prove that  

$$a_{j+1} : b_{j+1} = b_{n-j} : c_{n-j}$$
  
 Let  $p$  be first term and  $l$  last term.  
 Let  $g$  be com. diff. in A.P. and  $r$  be com. ratio in G.P.

$$g = \frac{l-p}{n-1} \quad r = \left(\frac{l}{p}\right)^{\frac{1}{n-1}}$$

and  $a_{j+1} = \frac{p(n-1) + j(l-p)}{n-1}$

$$b_{j+1} = p \left(\frac{l}{p}\right)^{\frac{j}{n-1}}$$

$$c_{n-j} = p \left(\frac{l}{p}\right)^{\frac{n-j-1}{n-1}}$$

$$\frac{p l (n-1)}{n-1} = \frac{l(n-1) + (n-j-1)(l-p)}{n-1}$$

and  $b_{j+1} = \frac{p(n-1) + j(l-p)}{p(n-1) + j(l-p)}$

$$b_{j+1} = (n-1) p \left(\frac{l}{p}\right)^{\frac{j}{n-1}}$$

$$\frac{b_{n-j}}{c_{n-j}} = \frac{p(n-1) + j(l-p)}{(n-1) p \left(\frac{l}{p}\right)^{\frac{j}{n-1}}} = \&c.$$

2. If  $p$  be nearly equal to  $q$ .

$\frac{(n-1)p + (n-1)q}{(n-1)p + (n+1)q}$  is a close approximation to

$$\left(\frac{p}{q}\right)^{\frac{1}{n}}$$

Let  $\left(\frac{p}{q}\right)^{\frac{1}{n}} = 1+x$

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

taking the first two terms of the series we have

$$x = \frac{p-q}{nq}$$

again, substituting this value in the above, we have

$$\frac{p}{q} = 1+nx \left(1 + \frac{n-1}{2} \frac{p-q}{nq}\right)$$

$$\therefore x = \frac{2(p-q)}{n(p+q) - (p-q)}$$

$$\therefore \left(\frac{p}{q}\right)^{\frac{1}{n}} = 1 + \frac{2(p-q)}{n(p+q) - (p-q)}$$

$$= \frac{(n+1)p + (n-1)q}{(n-1)p + (n+1)q}$$

and if  $\left(\frac{p}{q}\right)^{\frac{1}{n}}$  differ from 1 only in the  $(r+1)$ th decimal place, this approximation will be correct to  $2r$  places. For, in finding the first value of  $x$  we discarded all the quantities involving  $n^2$  and higher powers, that is all the quantities beginning at the  $(2r+1)$ th decimal place: hence, this result is correct to  $2r$  places.

3. Having given

$$yz + \frac{1}{yz} - ax - \frac{b}{x} = zx + \frac{1}{zx} - ay - \frac{b}{y}$$

$$= xy + \frac{1}{xy} - az - \frac{b}{z}$$

prove that if  $x, y, z$  be all equal,  $ab=1$  and that each member of this equation is equal to zero.

Taking 1st and 2nd members of this equation together and dividing by  $(y-x)$ , we have

$$z - \frac{1}{xyz} + a - \frac{b}{xy} = 0 \quad (4)$$

and taking the 1st and 3rd together

$$y - \frac{1}{xyz} + a - \frac{b}{xz} = 0 \quad (5)$$

$\therefore$  from (4) and (5)  $b = xyz$

and  $a = \frac{1}{xyz} \therefore ab = 1$

and substituting these values in the original equation, each member reduces to zero.

4. If  $\frac{ax-by}{z} = \frac{ay-bz}{x} = \frac{az-bx}{y}$  prove

that  $x = y = z$ ; each fract. =  $a-b$  and by equating them separately to  $a-b$ , we obtain

$$\frac{b}{a} = \frac{x-y}{y-z} = \frac{y-z}{z-x} = \frac{z-x}{x-y}$$

$\therefore (y-z)^2 = (z-x)(x-y), (z-x)^2 = (x-y)(y-z)$

eliminate  $x-y$  and we have  $(y-z)^3 = (z-x)^3$  whence  $z = x+y$ , similarly  $z = y+x$ . eliminate  $y$  from these and we get  $x = z$ , &c.

5. Prove that

$$3^n = 1 + n2^n + \frac{n(n-1)}{1 \cdot 2} 2^{n-2} + \frac{n(n-1)(n-2)(n-3)(n-4)}{1 \cdot 2 \cdot 3 \cdot 4} 2^{n-4} + \dots$$

$$(2+1)^n - (2-1)^n = 2^n + n2^{n-1} + \frac{n(n-1)}{1 \cdot 2} 2^{n-2} + \dots$$

$$-2^n + n2^{n-1} - \frac{n(n-1)}{1 \cdot 2} 2^{n-2} + \dots$$

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

$$= n2^n + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} 2^{n-2} + \dots$$

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

6. If A, B, C, are the angles of a triangle, then  $\sin(A-B) \sin C + \sin(B-C) \sin A + \sin(C-A) \sin B = 0$

This expression  $\sin(A-B) \sin(A+B) + \dots = \sin^2 A - \sin^2 B + \sin^2 B - \sin^2 C + \sin^2 C - \sin^2 A$ .

7. If  $\sin l = \frac{a-b}{a+b}, \sin m = \frac{b-c}{b+c}, \sin n = \frac{c-a}{c+a}$

prove that

$$\sec^2 l + \sec^2 m + \sec^2 n = 2 \sec l \sec m \sec n + 1$$

$$\sec^2 l = \frac{(a+b)^2}{4ab}, \sec^2 m = \frac{(b+c)^2}{4bc}, \sec^2 n = \frac{(c+a)^2}{4ac}$$

$$\therefore \sec^2 l + \sec^2 m + \sec^2 n = \frac{c(a+b)^2 + b(a+c)^2 + a(b+c)^2}{4abc}$$

$$= 2 \frac{(a+b)}{2\sqrt{ab}} \times \frac{(b+c)}{2\sqrt{bc}} \times \frac{(a+c)}{2\sqrt{ac}} + 1 = \&c$$

8. A started from Ottawa at 9 a.m. to walk to Chelsea. After he had walked  $1\frac{1}{6}$  miles, B started and overtook A half way there. A then increased his pace one fifth and B decreased his one-ninth, and they reached Chelsea together at 11.28 $\frac{1}{2}$  a.m. Find the distance to Chelsea.

Let  $x = A$ 's rate  $y = B$ 's and  $z = \frac{1}{2}$  distance.

Then from the second part of the question,

$$\frac{6}{5}x = \frac{8}{9}y \therefore x = \frac{20}{27}y$$

and from the first part

$$\frac{z-1\frac{1}{6}}{x} = \frac{z}{y} \therefore 2z = 9$$

9. O is the point in OA perpendicular to the straight line ABC, from which BC appears the longest; prove that

$$\tan COB = \frac{BC}{2AO}$$

The point in AO from which BC appears the longest is the pt. where  $AO^2 = AB \cdot AC$  or where the circle described through B & C touches l.

$$\text{Now } \tan COB = \tan(AOC - AOB)$$

$$\tan(AOC) - \tan AOB = \frac{BC}{1 + \tan AOB \tan AOC} = \frac{BC}{2AO}$$

10. An object is observed at three pts. A, B, C, lying in a horizontal line which passes directly underneath the object; the angles of elevation at A, B, C, are  $m, 2m, 3m$ , and  $AB = a, BC = b$ ; prove that the height of the object is

$$\frac{a}{2b} \sqrt{(3a-b)(a+b)}$$

Let the perpendicular from the object meet the one in D and let  $h$  denote the height of the object.

$$\tan m = \frac{h}{a+b+CD} \tan 2m = \frac{h}{b+CD}$$



$$\therefore \frac{h}{b+CD} = \frac{\frac{2h}{a+b+CD}}{\frac{h^2}{(a+b+CD)^2}}$$

$$\therefore CD = \sqrt{a^2 - h^2} - b$$

$$\text{again } \frac{h}{\sqrt{a^2 - h^2} + b} = \frac{\frac{h}{a + \sqrt{a^2 - h^2}} + \frac{h}{\sqrt{a^2 - h^2}}}{\frac{h^2}{a\sqrt{a^2 - h^2} + a^2 - h^2}}$$

$$= \tan. 3m$$

$$\therefore h = \frac{a}{2b} \sqrt{(3b-a)(b+a)}$$

MATHEMATICAL NOTES, SOLUTIONS, &c.

1. To shew that the series whose  $n^{\text{th}}$  terms is  $\sqrt{n^2 + 1} - n$  is divergent.

The series is  $1 + \sqrt{2} - 1 + \sqrt{5} - 1 + \&c.$

$$= 1 + \frac{1}{\sqrt{2+1}} + \frac{1}{\sqrt{5+1}} + \&c.$$

$> 1 + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \&c.$ , and is  $\therefore$  divergent.

2. A farm is let for £96 and the value of a certain number of quarters of wheat. When wheat is 38 shillings a quarter, the whole rent is 15 per cent. lower than when wheat is 56 shillings a quarter. Find the number of quarters of wheat which are paid as part of the rent.

Reducing the value of the wheat by  $\frac{1}{3}$  has the effect of reducing the whole rent 15 per cent.; hence it follows that the value of the wheat bears to the whole rent the ratio  $\frac{1}{10} \frac{5}{8} : \frac{1}{3} \frac{8}{8}$ , i. e., 7 : 15, and  $\therefore$  bears to the cash part of the rent (£96) the ratio 7 : 8, and hence the value of the wheat at 56 shillings a quarter is £84,  $\therefore$  number of quarters is 30.

PROBLEMS.

[We commence in this number a series of Problems which will be continued in subsequent numbers of the Magazine. Solutions to the Problems will be given the month after they appear.]

1. Having only a plane ruler with parallel straight edges, construct an isosceles triangle.

2. With the same, bisect a given finite straight line.

3. With the same, bisect a given rectilineal angle.

4. Also, find the centre of a given circle.

5. A body moves from rest with an acceleration which remains constant during certain successive equal intervals of time, but is changed at the expiration of each such interval, so that the space described in the  $n^{\text{th}}$  interval is always  $2^{\text{r}} - 2^{\text{n}}$  ( $2^{\text{n}+1} - 3$ ) times the space described in the first of them. If the velocity acquired at the end of the first interval be  $v$ , show that after a long lapse of time the velocity approaches a uniform velocity  $2v$ .

6. An engine, whose power is sufficient to generate in one second a velocity of 150 feet a second in a mass  $M$  (which is its own mass), is attached to a carriage, whose mass is  $\frac{1}{2} M$

by means of an inelastic weightless chain 3 ft. long; this carriage is attached in the same way to another whose mass is  $\frac{1}{2} M$ ; this to a third whose mass is  $\frac{1}{2} M$ . The engine and carriages are successively in contact when the train starts; show that the last carriage will begin to move with a velocity of 33 ft. per second nearly.

7. A number of equal heavy particles are fastened at equal distances,  $a$ , on an inelastic string and placed in contact in a vertical line; show that if the lowest be then allowed to fall freely the velocity with which the  $n^{\text{th}}$  begins to move is

$$\sqrt{\left\{ ag \frac{(n-1)(2n-1)}{3n} \right\}}$$

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

Prove that  $\frac{a+b+c+d}{a^2+b^2+c^2+d^2} = abcd.$

## SOLUTIONS TO THE EXERCISES IN TODHUNTER'S EUCLID.

(Continued from the October Number of "The Quarterly.")

281. Join GD, GE, DE; O the cen., AO meets DE at rt. ang.; hence GD is eq. to GE, and the ang. GDE to GED. But ADG is eq. GED eq. GDE; hence ADE is bisected by DG, therefore, &c.
282. The centres of these circles are found by bisecting the six exterior angles of the triangle; hence the bisecting lines are two and two in the same st. line
283. ABC the triang. Let the escribed cir. touch AB prod. in F, AC prod. in G, and BC in E. and let the inscribed cir. touch AB, BC, CA respectively in H, E, K. then AH is eq. AK (being tans. drawn from the same pt.), AF to AG, BH to BE, BF to BD, CK to CE, and CD to CG, so that BF and CG are tog. eq. to BC, as also are HB and KC, and HF eq. KG; hence BF eq. KC, then DE is the dif. between BE and BD. *i. e.*, between BH and BF. *i. e.*, between BH and KC. and therefore between AB and AC.
284. This follows at once from the fact that tans. from the same pt. to the same cir. are eq.
285. BD bisects ABC and DBO is a rt. ang. therefore BO bisects the ext. ang. at B; then as in IV. 4, it may be shewn that the perpendiculars from O are eq.
286. Let AB, AC prod. touch the cir. at G, H, then AB, BD tog. eq. AG eq. AH eq. AC, CD. so that AB, BD eq. half the perimeter of the triangle; so also CB, BF. Take away DB, BF com. to both and the rem. AF eq. rem. DC. &c.
287. Let AB, AC touch the given cir. at B, C. D its cen., join AD cutting the cir. in E; thro' E draw a tan. meeting AB, AC at F, G; from BA cut off BH eq. to FG. draw HK perp. to AB meeting AD at K, K shall be the cen. of the cir. reqd.
288. In the fig. IV., 3, join AB, BC, CD. then since the ang., MAB, MBA are eq. and tog. less than two rt. ang., therefore each of them is an acute ang., therefore the ang. ACB in the alt. seg. is an acute ang., &c.
289. Des. a cir. touching AB, BC, CD, three of the sides of the quad.; then if AD does not touch the cir. draw AE touching it and meeting CD at E, then (188) AE and BC are tog. eq. to AB and CE, but AD and BC are eq. to AB and CD, therefore AD eq. AE and ED, which is impossible, hence, &c.
290. Draw the tan. APB cutting HK, LM in A, B, then AB eq. HK or LM; also, since HL, KM are parallel and AB bisects HK, LM, therefore HL and KM are tog. double of AB, hence HK and LM are tog. eq. HL and KM.
291. Each of these lines bisects an ang. of the triang., hence, &c.
292. From 286 it will readily appear that the escribed cir. for any particular position of the third side will touch it in all its positions.
293. On AB, the given base, describe a seg. of a cir. containing an ang. eq. twice the given vertical ang., then a line drawn parallel to AB at a dist. eq. to the given rad. will cut this arc at the cen. of the inscribed cir.
295. A line thro' C parallel to AB.
296. The sides are eq. being chds. of the

- circumscribed cir. equidist. from its cen.
297. This line bisects the ang. thro' which it passes, hence any pt. in it is equidistant from the two sides, therefore the two sides are equally dist. from the cen. of the circumscribed cir., hence, &c.
298. PQR the com. chd., then sq. on PA eq. rect. RP, PQ eq. rect. CP, PB, hence, &c.
299. EF the tan., then the ang. FEC eq. EDC in the alt. seg. and hence eq. ABC, therefore AB is parallel to EF.
300. Let A be the pt. where the line joining the points (B, C) cuts the given line. Take D in the given line such that the sq. on AD eq. the rect. BA, AC, then the cir. des. thro' BCD shall be the cir. reqd.
301. Let A, B be the given pts., CD the given line, prod. AB to meet CD in E, from E draw EF perp. to ED and make EF eq. to the reqd. chd., in ED take EG such that the rect. FE, EG is eq. the rect. AC, CB, bisect EG in H, take C, D on opp. sides of H such that HC, HD each eq. half the given chd. C, D shall be the points reqd.
302. Let A be the pt. where the line bisecting

- the ang. between the two lines cuts the other line, A shall be the cen., from A drop a perp. AB on one of these lines, and on opp. sides of B take C, D such that BC, BD each eq. half the reqd. chd., AC is the rad. of the reqd. cir.
303. Place the triangles on the same base and apply III. 21.
304. Let A, B be the two given pts. and C the other given pt. Determine apt. D in AB prod, such that the rect. AD, DB eq. sq. on reqd. tan., then the perps. drawn from the points of bisection of AB, CD shall meet in the cen. of the reqd. cir.
305. The ang. APN eq. half ACB, hence eq. CAB, therefore, &c.
306. Draw EF tan. to cir. about ABE, then ang. FEB eq. EAB in alt. seg., hence eq. EDC, therefore EF touches the cir. about ECD.
307. The cen. of the inscribed cir.
308. AF bisects the ang. A and hence F is the middle pt. of the arc BFC, therefore FB eq. FC. Again, ang. FBC eq. FAC eq.  $\frac{1}{2}A$ , therefore OBF eq. half the sum of A and B, and is therefore eq. FOB, hence, &c.

MISCELLANEOUS SOLUTIONS.

1. If  $\frac{m}{x} = \frac{n}{y}$  and  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , prove that

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

Solution:—

Since  $\frac{m}{x} = \frac{n}{y} \therefore \frac{m^2}{x^2} = \frac{n^2}{y^2} = \frac{m^2 + n^2}{x^2 + y^2}$  and

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

Then  $\frac{x^2}{a^2} \times \frac{m^2}{x^2} + \frac{y^2}{b^2} \times \frac{n^2}{y^2} = 1 \times \frac{m^2 + n^2}{x^2 + y^2}$

$$\therefore \frac{m^2}{a^2} + \frac{n^2}{b^2} = \frac{m^2 + n^2}{x^2 + y^2}$$

2. Show that if  $ax^2 + bx + c = 0$  has equal roots, one of them is given by the equation  $(2a^2 - 2ab)x + ab - b^2 = 0$ .

Solution:—

Since  $ax^2 + bx + c = 0$ ,  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ;

$\therefore$  the roots are equal,  $b^2 = 4ac$ ,  $\therefore x = \frac{-b}{2a}$ .

Solving the equation  $(2a^2 - 2ab)x + ab - b^2 = 0$

also gives  $x = \frac{-b}{2a}$

3. Simplify  $(a+b)^4 + (a-b)^4 - 2(a^2 - b^2)^2$ ; and show that  $(a+b+c)(b+c-a)(a+c-b)(a+b-c) = 4a^2b^2$  when  $a^2 + b^2 = c^2$ .

Solution:—

(a) Expression =  $[(a+b)^2]^2 - 2(a-b)^2(a+b)^2 + [(a-b)^2]^2 = [(a+b)^2 - (a-b)^2]^2 = 16a^2b^2$ .

(b) Expression =  $[(a+b)+c][(a+b)-c][c-(a-b)][c+(a-b)] = [(a+b)^2 - c^2][c^2 - (a-b)^2] =$  (after substituting value of  $c^2$ )  $4a^2b^2$

## INTERMEDIATE EXAMINATIONS, JULY, 1879.

## CHEMISTRY.

Values.	QUESTIONS.	Values.	QUESTIONS.
4	1. What is understood in chemistry by the expression an "element" or an "elementary body?"	4	How could you distinguish between Marsh Gas and Hydrogen?
4	How could you show that air is not an element?	4	Between Olefiant Gas and Carbon Monoxide?
4	What is the difference between a mechanical mixture and a chemical compound?	4	5. In what respects does Sulphur resemble Oxygen?
4	How could you show that Nitrogen Monoxide is a chemical compound?	4	By what other means, besides burning Sulphur, can Sulphur Dioxide be prepared?
4	2. Describe any method of preparing Oxygen.	2 × 4	Explain its action with solutions (1) of Potash, (2) of Chlorine.
4	Write in symbols the reaction that occurs when Oxygen is prepared from Potassium Chlorate.	6	6. How much Phosphorus is contained in 120 lbs. of bone-ash consisting of 88.4 per cent. of $\text{Ca}_3(\text{PO}_4)_2$ and 11.5 per cent. of $\text{CaCO}_3$ ? ( $\text{Ca} = 40$ .)
4	You are given three vessels, and are told that one contains Oxygen; one, Nitrogen Monoxide; and one common Air; how would you determine which vessel contains the Oxygen?	6	What volume of Hydrogen is contained in one ounce of Microcosmic Salt $\text{NaNH}_4\text{H}_2\text{P}_2\text{O}_7 \cdot 4\text{H}_2\text{O}$ ? (37 grains of Hydrogen to the cubic foot; $\text{Na} = 23$ .)
4	What volume of Oxygen will 8 ounces of Potassium Chlorate yield; a cubic foot of Hydrogen at $60^\circ \text{F}$ . and 30 ins. Bar. weighing 37 grains. ( $\text{K} = 39.1$ .)	8	7. What is the simplest formula that can be assigned to a substance containing Carbon, 54.5 } Hydrogen, 9.2 } per cent? Oxygen, 36.3 }
4 × 4	3. How may Nitrogen, Nitric Oxide ( $\text{NO}$ ), Nitrous Anhydride ( $\text{N}_2\text{O}_3$ ), and Nitrogen Peroxide ( $\text{NO}_2$ ) be severally obtained from Nitric Acid or a Nitrate?	5	8. The chimney-glass increases the brightness of the flame of the common coal-oil lamp; why does it do so?
4	4. How could you distinguish Carbon Dioxide from Nitrogen?	5	If you drive a current of air into the flame of an ordinary candle, the flame appears less bright than it did before the introduction of the air. Explain why this is the case.
4	The gas that sometimes collects at the bottom of deep wells is said to be Carbon Dioxide. By what experiments could you test the correctness of this statement?		

## ANSWERS.

1. (a). The term "element" is applied to those constituents of matter which chemists have not been able to resolve into simpler bodies: in short, the term "element" is given to those substances out of which the earth, and all things thereon, are made, either by the simple bodies existing alone, or in combination with each other.

(b). That air is not an *element* can be shown by burning Phosphorus in a given volume; only a portion of it will be consumed. Thus, if a graduated jar be inverted and placed over water on which floats a capsule containing burning P., it will be found that about one-fifth part of the air will disappear, and its place will be filled by the water. The white fumes formed by the burning P. will be dissolved by the water. Now, were the air an element, it should be wholly consumed by the P, or else none of it should disappear; so we see that the remaining portion of the gas in the jar will not support combustion, as did the part which has united with the P, therefore, air is composed of at least two kinds of matter.

(c). A "mechanical mixture" is a mixture of two or more substances (each of which may be an element or a compound), in which each component retains its original properties, and which may be separated by mechanical means. A chemical compound differs from a mixture in that it has properties different from any of the component parts. In a mechanical mixture, the components may be present in any proportions, but in a chemical compound, the parts are present in definite proportions, and can only be separated from each other by a difficult chemical operation.

(d). That Nitrogen Monoxide is a chemical compound can be shown by filling two test tubes, one with air, the other with Nitrogen Monoxide, and passing into each a solution of Pyrogallate of Potash. From the vessel filled with air, the Oxygen will be absorbed, but not from that containing Nitrogen Monoxide. Or again, if Nitrogen Dioxide be passed into the vessel containing air, brown fumes  $N_2O_3$  and  $N_2O_4$  will be produced, showing that

the gas  $N_2O_2$  has absorbed Oxygen from the air present; but if it be passed into a vessel of Nitrogen Monoxide, no change is produced, showing that the O of the  $N_2O$  is combined or locked up with the Nitrogen.

2. The best way of preparing Oxygen is to heat Potassic Chlorate, mixed with about one-third its weight of Manganese Dioxide, when all the Oxygen will be given off and Potassic Chloride and unchanged Manganese Dioxide will remain. The object of the Manganese Dioxide is to allow the Oxygen to come off at a lower temperature than the Potass. Chl. would require if heated alone. The equation is  $KClO_3 = KCl + O_3$ . Again, Oxygen may be prepared by heating Mercuric Oxide,  $HgO$ , when the O will be driven off and Mercury will condense in cooler parts of the tube. On a large scale O can be prepared by heating to a very high temperature, in an iron retort, Manganese Dioxide. In this case only one-third of the O is given off. The equation is  $3 MnO_2 = Mn_3O_4 + O_2$ .

The two gases Oxygen and Nitrogen Monoxide both rekindle a glowing taper, both support combustion vividly, but are distinguished by passing Nitrogen Dioxide into each. In the vessels containing Oxygen and air, brown fumes will be found, but in vessel containing Nitrogen Monoxide, no fumes will be found. Then vessels containing air and Oxygen can be distinguished by Pyrogallate of Potash as mentioned in question 1.

Atomic wt. of Potassium is 39.1, of Cl. 35.5, and O 16, therefore Potass. Ch.,  $KClO_3$ , 122.6 parts yields 48 parts O; hence, 8 oz. will give 3.132 oz. of O, but each cubic foot of O weigh 592 grains, the vol. of O =  $3.132 \text{ oz.} \div 592 \text{ grains} = 2.54$  cubic feet.

3. (a). If a Nitrate as  $KNO_3$  be heated with charcoal the Nitrogen is liberated in a free state. Carbonic Acid is formed by the union of the Oxygen with a necessary quantity of Carbon, and the Carbonic Acid thus unites with the Potash. It is owing to the sudden liberation of Nitrogen from such mixtures that the explosive value of gun powder is derived.

(b). When Nitric Acid acts on Copper,

Copper Nitrate, Water and Nitrogen Dioxide or Nitric Oxide are produced, thus  $3\text{Cu} + 8\text{HNO}_3 = 3\text{Cu}(\text{NO}_3)_2 + \text{N}_2\text{O}_2 + 4\text{H}_2\text{O}$ .

(c). When Starch or Arsenic Trioxide is boiled with Nitric Acid, Nitrogen Trioxide (or Nitrous acid Hydride) is given off, thus:  $\text{As}_2\text{O}_3 + 2\text{HNO}_3 + 2\text{H}_2\text{O} = 2\text{H}_3\text{AsO}_4 + \text{N}_2\text{O}_3$ .

(d). Nitrogen Tetroxide ( $\text{NO}_2$ ) can be prepared by heating Nitrate of Lead, when it is broken up, into Oxide of Lead, and Oxygen Nitretetroxide  $\text{Pb}(\text{NO}_3)_2 = \text{PbO} + \text{O} + \text{N}_2\text{O}_4$ . This gas, mixed with  $\text{N}_2\text{O}_3$ , is also produced when  $\text{NO}_2$  comes in contact with air or Oxygen.

4. (a). Neither Carbon Dioxide or Nitrogen will support combustion, but if lime water be put into a flask containing the former, it will become muddy from the formation of Calcium Carbonate.

(b). This is answered above, when test for Carbon Dioxide is given.

(c). Marsh gas is heavier than Hydrogen, as it contains Carbon it burns with a more luminous flame, producing both Water and Carbon Dioxide, which, tested for as above, distinguishes it from Hydrogen, which produces only Water when burnt.

(d). Olefiant gas burns with a much more luminous and smoky flame than Carbon Monoxide. It can be recognized by its peculiar odor. Both gases produce Carbon Dioxide when burnt, but only the Olefiant gas produces Water, hence, it can be thus determined.

5. (a). Sulphur resembles Oxygen in forming a number of Sulphides which are an analogous to Oxides, thus:

$\text{H}_2\text{O}$	is analogous in composition to	$\text{H}_2\text{S}$ .
$\text{KHO}$	“	$\text{KHS}$ .
$\text{K}_2\text{O}$	“	$\text{K}_2\text{S}$ .
$\text{Ag}_2\text{O}$	“	$\text{Ag}_2\text{S}$ .

(b). Sulphur Dioxide can be prepared by boiling Copper, Mercury, Carbon, and with Sulphuric Acid, thus:  $\text{Cu} + 2\text{H}_2\text{SO}_4 = \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2$ .

(c). Sulphur unites with Potash to form Potassic Sulphite, thus:  $\text{KHO} + \text{SO}_2 = \text{KHSO}_3$  or  $2\text{KHO} + \text{SO}_2 = \text{K}_2\text{SO}_3 + \text{H}_2\text{O}$ .

(d). Sulphur Dioxide slowly removes the Oxygen from the water in which it is dissolved, while Chlorine tends to remove the Hydrogen from the water in which it is dissolved, therefore the mixed solutions break up a portion of the water, the Oxygen uniting with the Sulphur Dioxide to form Sulphuric Acid, and the Hydrogen uniting with the Chlorine to form Hydrochloric Acid. Therefore, Sulphuric and Hydrochloric Acids result from the mixture of the solutions.

6. In each lb. of bone ash  $\frac{62}{40_3 + (31 + 16_4)_2} = \frac{1}{2}$  consists of Phosphorus; therefore  $\frac{1}{2}$  of  $120 \times \frac{62}{100}$  or 212.16 lbs. consists of Phosphorus.

In 480 grains of Microcosmic Salt  $\frac{13}{23 + 14 + 4 + 1 + 31 + 64 + 4(18)} = \frac{1}{27}$  of the whole is Hydrogen,  $\frac{1}{27} \times 480 = 29.8$  is quantity of H.  $29.8 \div 37 = .805$  cubic feet.

7. Percentages of chemical constituents in a compound substance are the numbers expressing the relative weight of the components to each other. The molecular formulæ express the ratio of the components to each other in number of atoms. From the percentage composition, the former can be found by expressing the ratios of the components in the percentage weights divided by their atomic weights, thus:  $\text{C} : \text{H} : \text{O} :: \frac{54.5}{12} : \frac{9.2}{1} : \frac{36.3}{16}$ . Clearing of fractions the formulæ becomes  $\text{C}_2\text{H}_4\text{O}$ .

8. (a). In the flame of an ordinary coal oil lamp, without a chimney, much of the Carbon of the oil is unconsumed from want of Oxygen. The illumination is not brilliant, first, on account of the smoke, and again because the temperature of the flame is not at its greatest, since part of the burning material is unconsumed for want of air. If the chimney be placed on the lamp, a current of air rushes through, burning up the Carbon, thereby clearing the light of soot and raising temper-

ature to a high heat, and thus producing a white light.

(b). If air be forced through the flame it causes perfect combustion, in which case there

are no solid particles of Carbon separating from the burning material, which, when heated, (without an extraordinary supply of air,) forms some of the light of a candle.

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## PUBLIC SCHOOL DEPARTMENT.

### TIME TABLES.

IN every well conducted Public School a suitable time table is of primary importance, in fact no school can be judiciously managed, nor can the time at the disposal of the teacher be profitably employed, without it. "A time for everything, and everything at its time," is an adage the truth of which is especially felt in the schoolroom. Every one who has been connected with the teaching profession must know that the formation of a time table is one of the most difficult portions of a teacher's duty. The number of classes to be heard, as well as the great variety of subjects taught, require the most careful consideration, so that each may receive its proper share of attention. Without a properly prepared time table, it is quite possible, nay, very probable, that some subjects will receive undue prominence, while others of equal or greater value will be passed over in a very cursory manner, if not neglected altogether. It must be apparent to every one that the proper succession of classes and an equitable distribution of time to the various subjects according to their relative value, are of such vital interest to the welfare of the school that no teacher can safely ignore either one or the other. Whoever neglects this important feature of school economy is very apt to prove a failure, and the pupils under his charge must suffer

accordingly. No teacher who honestly prides himself upon the successful management of his school will permit himself to be without this necessary guide through the various duties and cares of the schoolroom. Not only is a properly prepared time table of use to the teacher, but it is of even greater importance to the pupils. These require to be taught the proper economy of time.

It being granted, then, that a carefully prepared time table is an essential requisite for every school, the question very naturally arises, how shall such be prepared, and what should be its principal features? Before attempting to answer these questions, it may be remarked that in schools that are properly graded, time tables are much more easily arranged than in rural schools. This arises from the fact that in graded schools each teacher has charge of only one class, while in the average rural school one teacher is required to take charge of five and sometimes six different classes, and to see that the various studies prescribed for these receive proper attention.

A time table is simply a record of the work required to be done during school hours, by both teacher and pupils, in the order in which it is to be done, and the time allotted for each separate portion of it. In preparing it

the teacher will have to determine the just proportion of time to be given to each subject, and to each class as well. The length of any recitation should seldom exceed half an hour, though more than that may be allowed if several subjects are grouped together, as, for example, when reading, dictation and parsing or analysis are taken up in succession before the class is dismissed. In the junior classes short recitations, say of ten minutes, should be the rule, and this should not be exceeded unless the class is exceptionally large. These pupils have not yet learned the art of preparing lessons, and therefore short and frequent exercises will accomplish more, and keep the little ones in better discipline. With the more advanced pupils a longer time may be allowed; but even with these it is difficult to keep the attention fixed on the subject, especially if the lesson requires close thought, and the recitation is a long one. On the other hand, too short recitations are equally objectionable, as they tend to destroy discipline, distract the attention of pupils studying at their seats, and waste a great deal of time in calling up and dismissing classes. The judicious teacher will therefore assign lessons of such length as may profitably occupy the time allotted for them.

Another important point in the construction of a time table is the order in which the subjects required to be taught are taken up. Some teachers prefer the early part of the day for the mathematical subjects, while others take up reading, including the literature of the lesson, with dictation and either parsing or grammatical analysis. It would be well, after the opening exercises are over, to call up one of the more advanced classes for recitation, thus allowing the junior classes an opportunity of looking over the lessons assigned them. After this senior class has finished, the junior classes may be called in order, com-

mencing at the lowest. In the writer's opinion, reading, with the literature of the lesson read, should occupy the early part of the day, while the mind is active and vigorous, and the other subjects follow in the order of their importance. Penmanship and drawing should never follow immediately after a recess, as the nerves are then very apt to be unsteady. Subjects requiring little thought should occupy the latter part of the day.

After a time table has been adopted, it should be rigidly adhered to in every particular, as any deviation from its provisions would tend to promote irregularity and confusion, and destroy the confidence of the pupils in its usefulness. If at any time, it is found from experience that certain changes are necessary, let these changes be made, and the reasons therefor explained to the school. A certain time should be allowed for recess, so as to prevent as far as possible, the habit of pupils going in and out of school during the time for study and recitation. The time table should show the subjects for study as well as for recitation, and provision should be made for the employment of the full time of each and every pupil during school hours.

The following general form is submitted to teachers with the hope that it may prove suggestive if not useful. No subjects have been filled into this form, as there may be a difference of opinion as to which should occupy the earlier and which the latter portions of the day. The length of time allotted to the study of each subject, as well as the time for recitation, are shown; the left hand column showing the time, and the succeeding columns the subjects for study and for recitation in each class. By this means each pupil will know exactly the time he has in which to prepare his lessons in each subject, and also when he will be called upon to recite. If care is used in properly arranging the work



for each class, a word or two of command will enable the teacher, not only to dismiss the class reciting, but to

change the subjects of study in any of the classes employed in study at their seats.

TIME.	FIRST CLASS.		SECOND CLASS.		THIRD CLASS.		FOURTH CLASS.	
	Study.	Recitation.	Study.	Recitation.	Study.	Recitation.	Study.	Recitation.

EXAMINATION PAPERS.

It has been suggested to us by Public School Inspectors, that specimens of examination papers set for pupils passing from the Second to the Third, and also from the Third to the Fourth Class—Public School Course—would be acceptable to many Public School Teachers. We accordingly give the following examination papers, prepared for the Christmas Examinations in this city, as models for the guidance of teachers and others in examining their pupils.

FROM IV. TO V. GRADE.—CITY SCHOOLS.

FROM II. TO III. CLASS.—PUBLIC SCHOOL COURSE.

(1) *Reading*.—Page 160, II. Reader, from "Quick as thought," to "had saved his life." Value 30 marks—1 to 5 for natural tone of voice; 1 to 5 for articulation and emphasis; 1 to 5 for ease and fluency; from the remaining 15 marks deduct 1 for each omitted, inserted or miscalled word.

(2) *Dictation*.—Spell on paper to dictation from II. Reader, page 164, from "In one of the new settlements,"

to "brought them home." Value 22 marks—two off for each error in spelling.

(3) *Penmanship*.—Write on paper from page 118, II. Reader, (a) the heading of the lesson, (b) the last six lines on page 119, (c) three lines of the ten digits. Value 20 marks—1 to 5 for display; 1 to 5 for formation of figures; 1 to 10 for formation of letters.

(4) *Arithmetic*.—Multiply 987653 by 8907.

II. From 291234762 take 198769487

III. From the product of 98307 by 629 take 543 multiplied by 697.

IV. Write Roman Characters for 809, 916, 789, 694 and 237.

V. Multiply the difference between 69307 and 74183 by 4 times the sum of 89 and 93.

VI. Find the sum of 98307, 86349, 8037, 76039, 83479, 9007 and 8237963.

VII. The subtrahend is 5346798, the difference is 1888164; find the minuend.

VIII. If a pint of peanuts costs 40 cents, how much more ought 14 pints to cost than 10 pints?

IX. A. has 90 acres of land, B. 80 acres, C. 100 acres, and D. has 40

acres less than the other three men ; how many has D. ?

X. Find the result when 987 is repeated 9807 times.

Value 100 marks—10 each.

(5) *Geography*.—(To be dictated slowly.) I. Draw on slates the outline of Wentworth County, (*b*) draw lines dividing it into Townships, (*c*) write in the names of the Townships, Dundas, Hamilton, Burlington Bay, Lake Ontario, Stoney Creek, Waterdown.—Value 30 marks.

II. Name (oral) 9 cities in Ontario, and tell what County each is in.—Value 18 marks.

III. Name (oral) 4 rivers in Ontario, and tell what they flow into.—Value 8 marks.

IV. Spell (oral) Huron, Monck, Dunnville, Essex, Ottawa, Belleville, Guelph, Lincoln, Simcoe, Peel.—Value 10 marks.

V. What railroad runs from the Falls to Detroit? from Hamilton to Toronto? from Hamilton to Barrie?—Value 6 marks.

(6) *Literature*.—(Open book, II. Reader, at page 176.) I. (oral) What is meant by *craft* (2nd l.)? give another meaning for that word ; give the meaning of *cruise* (2nd l.) ; spell another word of that sound and give its meaning ; give the meaning of *buoy* (3rd l.), *moored* (4th l.), *mishap* (5th l.), *attention* (7th l.) In 10th l. what is the mark after *man*? Why is it there? What letter is omitted in *don't*. Value 33 marks—3 × 11.

II. (Page 229.) Give the meaning of *completed* (4th l.), *set sail* (6th l.), *restored* (11th l.), *regarded* (12th l.), *venture* (18th l.), *basted* (24th l.), *dripping* (25th l.), *plight* (26th l.) Value 24 marks—3 × 8.

III. Why is *African* spelled with a capital? What mark is that after *Mr.*, and why is it there? What is a *poet*? Where and what is *London*? What is meant in 21st line by "*losing his 2 its.*" Value 15 marks—3 × 5.

Total value 72 marks.

(7) *Music*.—Simple songs by rote. Value 20 marks.

(8) *Drawing*.—Drawing to dictation horizontal, vertical, straight, broken and other lines, making squares, circles and angles. Value 20 marks.

#### FROM VII. TO VIII. GRADE.— CITY SCHOOLS.

#### FROM III. TO IV. CLASS.—PUBLIC SCHOOL COURSE.

(1) *Reading*.—Page 248, III. Reader—all the page. Value 30 marks—1 to 5 for natural tone of voice ; 1 to 5 for articulation and emphasis ; 1 to 5 for ease and fluency ; from the remaining 15 marks deduct 1 for each omitted inserted or miscalled word.

(2) *Dictation*.—Spell on paper to dictation from page 281, III. Reader, from "Another great article of food," to "seems like liquid fire." Value 22 marks—two off for each misspelled word.

(3) *Penmanship*.—Write on paper from page 294, III. Reader, (*a*) the heading of the lesson, (*b*) the last eight lines of the page, (*c*) three lines of the ten digits. Value 20 marks—1 to 3 for display ; 1 to 7 for formation of figures ; 1 to 10 for formation of letters.

(4) *Grammar*.—I. How are adjectives distinguished from adverbs? Value 6 marks.

II. Define letter, syllable, word, sentence. Value 8 marks.

III. Name the vowels and consonants in the word *parvly*. Value 5 marks.

IV. What parts of speech are most important, and why? Value 6 marks.

V. What is a word of four syllables called? Value 5 marks.

VI. III. Reader, page 211.—Place the 38 words, commencing "He threw down," to "he went along," in a column, and opposite each word write its part of speech. Value 70 marks—2 marks off for each one improperly

named. One mark off the whole paper for each misspelled word.

(5) *Composition*.—I. What is a sentence?

II. Name the different kinds of simple sentences.

III. Write two interrogative sentences.

IV. Form two declarative sentences on the subjects *house* and *city*.

V. What kind of sentences are the following: (a) Remember the regulations of the school. (b) John occasionally comes late.

VI. Write your own name and your teacher's name in full.

VII. Where do you use capitals in writing?

VIII. Write a letter of from 5 to 8 lines in length to a cousin in Toronto, telling whether you expect a prize at this examination.

Value 72 marks—8 for each of the first seven questions, and 16 for the letter. The letter must be in proper form, and all sentences must begin with capitals and end with proper points. One mark off the whole paper for each misspelled word.

(6) *Geography*.—(To be dictated.)

I. Draw on paper an outline of the map of the Dominion, but put in no names—(time for outline 30 minutes.)

II. Print in your map, in their proper places: Atlantic Ocean, Pacific, Arctic, Hudson Bay, James Bay; Lakes Erie, Ontario, Huron, Superior, St. Clair, St. Peter, St. John, Great Bear; Gulf of St. Lawrence; Bay of Fundy, Baffin's Bay; Hudson Strait, Davis Strait; Rivers Mackenzie, St. Lawrence, Ottawa, Niagara, Red, Thames, St. Johns, Grand, St. Clair, Detroit; Islands VanCouver, Prince Edward, Manitoulin, Navy, Montreal, Anticosti, Newfoundland; Cape Breton; Provinces Ontario, Quebec, New Brunswick, Nova Scotia, Manitoba, British Columbia, Northwest Territory, North-east Territory, Keewatin; Cities St. John, St. Johns,

Halifax, Charlottetown, Quebec, Montreal, St. Hyacinthe, Ottawa, Belleville, Toronto, St. Catharines, Hamilton, Guelph, Brantford, London, Kingston, Winnipeg, Westminster; Towns Chatham, Windsor, Barrie, Keewatin, Sarnia, Niagara, Cobourg, Orillia, Battleford. Value 72 marks—one for each name correctly spelled and placed.

(7) *Literature*.—(III. Reader open at page 209.) I. Why do you commence with a capital *I* (1st l.), *My* (2nd l.), *Solitude* (5th l.)? What and why are those marks after *Solitude* (5th l.), and *face* (6th l.)? By whom are these verses supposed to be spoken? Give the meaning of *dispute* and *sages* (1st verse), *indifference* (2nd verse), *assuage* and *sallies* (3rd verse.) Value 33 marks— $3 \times 11$ .

II. In page 210, what is meant by "a glance of the mind"? Why is light called *swift-winged*? Give the meaning of *lags* (1st verse), *lair*, *repair*, *grace*, *reconciles* (2nd verse.) Tell what you know about the author of these verses. Value 24 marks— $3 \times 8$ .

III. In page 239, give the meaning of *prevailed* (3rd l.), *portable* (4th l.), *regulars* (5th l.), *subjugation* (10th l.), "free, loyal and happy people," (11th l.). What people? Value 15 marks— $3 \times 5$ . Total value of paper 72 marks, from which deduct 1 for each error in spelling.

(8) *Arithmetic*.—I. What must be added to 987362 to make it exactly divisible by 865?

II. In a circus the ring was 120 yards in circumference, and there were 20 horses; each horse went around it 15 times; how many miles, &c., did they all travel?

III. Divide 123 mls., 3 fur., 12 po., 2 yds., 2 ft., 11 in., by 121 by factors.

IV. Divide \$140 between A, and B., so that A's share shall be equal to  $\frac{3}{4}$  of B's share.

V. A has  $\frac{3}{4}$  of a sum of money, B  $\frac{1}{4}$  and C the remainder; if A has \$24 more than C, how much has each man?

VI. Find the L. C. M. of all the composite numbers from 1 to 20 inclusive.

VII. If I had \$400 more, I could pay a debt of \$1,500 and have \$37 over; how much have I?

VIII. A man walks at the rate of 3 miles an hour; how long would it take him to go round a field 120 rods long and 80 rods wide?

IX. A man having 500 acres of land divided it into portions of 16 ac., 3 roods, 17 sq. po., 19 sq. yds., each, and sold 17 of these portions; how many acres, &c., had he left?

X. When 98 mls., 7 fur., 13 po., 3 yds., 2 ft, 8 in., is repeated 87 times, what is the result?

Value 100 marks—10 for each question.

(9) *Drawing*.—What is an ellipse?

What is a simple curve, and how does it change its direction? Describe the compound curve and also the reversed curve. How is the square to be divided into 12 equal parts, and what forms will we then have? Name the curves forming the sides of a pitcher? Describe the method of drawing a square. Having drawn a square and its diagonals, name the angles. Compare the oblong and square. When are lines said to be parallel? What should be done before drawing the diameters of a square? Value 20 marks.

(10) *Music*.—Write a major scale in the key of G, with proper signature; also key of D and key of C. Transpose the following [an easy tune set in the key of C, to the] key of G, and write the Italian letters for the notes. Value 20 marks.

ARITHMETIC AND MENSURATION.

SECOND CLASS CERTIFICATES, JULY, 1872.

1. Prove the rule for finding G. C. M. of two numbers, Text Book.

2. In the *Globe* of 21st April, gold is quoted at 111¼. Find discount % on greenbacks.

Solution:—

$$\begin{aligned} 111\frac{1}{4} \text{ greenbacks} &= 100 \text{ gold.} \\ 100 &= 89\frac{7}{8} \end{aligned}$$

i. e., \$1 greenbacks is only worth 89⅞ c. gold; ∴ 100 — 89⅞ = 10⅛ % discount.

3. I invest \$13,450 in stock of Bank of Commerce at 134½, the half-yearly dividends being 4½ %. Find my annual income from the investment.

Solution:—

$$\begin{aligned} \$134\frac{1}{2} &\text{ gives } \$9 \text{ income per annum.} \\ \$13,450 &\text{ " } \$900 \text{ " " " " } \end{aligned}$$

4. A farmer sold his crop of wheat in 1871 for 8% more than he obtained for his crop of the preceding year; he received for both crops \$2,600; how much did he get for his crop of 1870?

Solution:—

One crop would sell for 100, the other for 108; ∴ the two would sell for 208.

$$208 = \$2,600, \text{ or } 100 = \$1,250.$$

5. Reduce to simplest form

$$\frac{3\frac{3}{4} \quad 5\frac{3}{4} - 1\frac{1}{3}}{6\frac{1}{2} \quad 5\frac{3}{4} + 1\frac{1}{3}} \times \frac{5\frac{2}{6}}{3\frac{2}{6}} - 3\frac{2}{6}$$

Solution:—

$$\frac{15}{26} + \frac{91}{20} \div \frac{139}{200} \times \frac{139}{26} - 3\frac{2}{6} = \frac{15}{26} + \frac{91}{26}$$

$$= \frac{107}{26}$$

6. A grocer has three kinds of tea, costing 30, 45 and 60 cents a lb. respectively; what quantities of each must he take to form a mixture of 144 lbs. worth 40 cents a lb.?

Solution:—

	c.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
	30	10	10	1	2	3	72
40c.	45	20		2		2	48
	60		5		1	1	24

i. e., 72 lbs @ 30c., 48 lbs. @ 45c., and 24 lbs. @ 60c. 10 lbs. @ 30c. would gain as much, being sold @ 40c., as 20 lbs. @ 45 would lose, being also sold @ 40c., and similarly for the 60c. tea. Care must be taken that a loss is opposed to an equal gain.

7. A commission merchant sold a consignment of goods on 3% commission, and was instructed to invest (on 2% commission) in other goods, the commission for both transactions to be deducted in advance. His entire commission was \$265. Find value of the goods he purchased.

Solution :—

$$\frac{3}{100} + \frac{2}{102} \text{ of } \frac{97}{100} = \frac{5}{102} \text{ or, the total com,}$$

$$\therefore \frac{97}{102} = \text{amount invested.}$$

$$\frac{5}{102} = \$265. \quad \frac{97}{102} = \$5,141.$$

8. Find cost of papering a room 29 ft. 6 in. wide, 36 ft. 6 in. long, and 13 ft. 6 in. high, with paper 2½ ft. wide, and costing \$2.20 per piece of 12 yds. long, the parts not requiring paper making up ⅓ of whole surface.

Solution :—  
 $(29\frac{1}{2} + 36\frac{1}{2}) 2 = 132 \text{ ft., total length of four walls.}$

$$132 \times 13\frac{1}{2} \times \frac{1}{3} = \text{sq. ft. to be papered.}$$

$$\$2.20 \div (2\frac{1}{2} \times 36) = \text{cost per sq. ft.}$$

$$\therefore 132 \times 13\frac{1}{2} \times \frac{1}{3} \times 2.20 \times \frac{1}{36} = \$31.68, \text{ total cost.}$$

9. Two persons travelling together agree to pay expenses in the ratio of 7 to 5. The first (who contributes the greater sum) pays away on the whole, \$103.20; the second, \$63.40. What must one pay the other to settle the affair according to agreement?

Solution :—

$$\$103.20 + \$63.40 = \$166.60.$$

$$\frac{7}{12} \text{ of } \$166.60 = \$97.18\frac{1}{3} \text{ or greater share.}$$

$$\therefore \$103.20 - \$97.18\frac{1}{3} = \$6.01\frac{2}{3}.$$

10. The sides of a triangle are 30, 40 and 50 respectively. Find the area of the triangle formed by joining the middle points of these sides.

Solution :—  
 The figure is a right-angled triangle; the line joining the middle points of two sides parallel to the third side, therefore a new right-angled triangle will be formed, whose sides are resp. 15, 20 and 25. The area, therefore, is  $15 \times 20 \div 2$ , or 150.

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We have ventured to send a copy of THE SCHOOL MAGAZINE to a large number of teachers and other friends of education who were not in receipt of *The Quarterly*, in the hope that our present venture will be found of sufficient merit to commend itself to them and to secure their support.

Those to whom this number 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. Where nothing further can be done we will take it kindly if they will send us lists of names

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## TO ADVERTISERS.

We wish to bring before the notice of our readers the advantages which THE SCHOOL MAGAZINE offers as an advertising medium. This Magazine takes the place of *The Quarterly*, which has just completed the fifth year of a most successful career. Its aim is to supply Teachers and Students with valuable and suggestive material for private study and class-room work. It will, therefore, as an advertising medium, combine all the advantages of a book announcement and a Magazine advertisement. Being used for the purpose indicated, its advertisements will be frequently seen and cannot fail to become familiar to its readers. It will be circulated largely among Inspectors, Teachers, Students, Ministers, and other friends of education.

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Our many excellent exchanges will have to excuse us for not calling attention to them in the present issue of THE SCHOOL MAGAZINE. We have so much that we desire to place before our readers that we must necessarily omit something. We hope to do better in this respect in next issue.

Those whose time of subscription of *The Quarterly* has not expired will receive, in its stead, as many numbers of THE SCHOOL MAGAZINE as they were entitled to of *The Quarterly*.

As our desire is not to be sectional but to do the greatest good to the greatest number, we shall be glad to receive hints and questions bearing on the subjects treated of in THE SCHOOL MAGAZINE from any source. We base our remarks on the Hamilton Schools, and give examination

papers used therein, not because they are better than those of other places, but because they are more readily available to us at present. We shall be glad to receive sets of promotion examination papers from other Schools, and will give insertion to contributions on useful school topics, when well written and in good form.

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