Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☑ Bound with other material/ Relié avec d'autres documents
- ☑ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☐ Pages detached/ Pages détachées
- ☑ Showthrough/ Transparence
- ☑ Quality of print varies/ Qualité inégale de l'impression
- ☑ Continuous pagination/ Pagination continue
- ☐ Includes index(es)/ Comprend un (des) index

  Title on header taken from:/ Le titre de l'en-tête provient:
- ☐ Title page of issue/ Page de titre de la livraison
- ☐ Caption of issue/ Titre de départ de la livraison
- ☐ Masthead/ Générique (périodiques) de la livraison

☐ Additional comments:/ Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
						✓					

THE

SCHOOL MAGAZINE.

MAY, 1881.

HEALTH DEPARTMENT.

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

THE SCHOLAR'S EYE.

IX.

THE EYE IN ITS RELATIONS TO TYPE, INK, PAPER, PROLONGED TENSION.

IF the reader refer to the first of these nine articles on *The Scholar's Eye*, he will find the statement that the smallest printed matter which can be recognized by the average normal eye must subtend an angle of five minutes at the eye. This has been established and is now accepted by oculists the world over. Many of their calculations, which partake of the nature of scientific exactness, is based upon this assumption. It is then to be accepted. Now, the smaller an object, the nearer it must be brought to the organ of vision to be perceived. Accordingly, that extremely fine type. known to printers as "Brilliant," and which is about $\frac{1}{5}\frac{1}{0}$ of an inch in height, must be brought to a distance of one foot before it can be recognized by even a healthy eye. Now most adults hold a book beyond this distance and at about eighteen inches, so that type of the height of about $\frac{1}{3}\frac{1}{0}$ of an inch is requisite for that distance. The reader should verify these fractions by actual calculation. However, even the normal eye should never be subjected for any considerable length of time to type so small as that. Type of $\frac{1}{3}\frac{1}{0}$ of an inch is quite small enough and rather too small even after we pass the prime of life. However, the use of spectacles largely removes the necessity for increasing the size of type with advancing years. Now, the finer the type, so much the closer must the book be brought to the eye, and this puts the eye to a higher degree of tension, so as to focus or bring the axes of both eyes to converge to an absolutely near point. The powers of accommodation are taxed and that without any sufficient or unavoidable reason therefor. It can be avoided by using larger type. Long continued use of eyes upon objects which are brought close to them is maintained by all authorities to be one of the most, if not the most, fertile causes of progressive nearsightedness. This muscular tension necessary to obtain clear vision of a near object induces redness in the deeper parts of the eye more than in the external.

This going on from month to month may and does permanently injure vision and even destroys it. One of the elements in the production of eye disease in both its outer and inner structures is the use of too fine print. Donders, the highest authority on the subject, says:

"The distribution of nearsightedness chiefly in the cultivated ranks points directly to its principal cause: tension of the eye for near objects. Respecting this fact there can be no doubt."

Three factors may here come under observation:—

"First, pressure of the muscles on the eye-ball in strong convergence of the visual axes; second, increased pressure of the fluids resulting from accumulation of blood in the eyes in a stooping position; third, congestive processes in the eye which, tending to softening, give rise to extension of the membrane. Now, in connection with the causes mentioned, the injurious effect of fine work is by imperfect illumination still more increased."

"To this is to be ascribed that in schools where, by bad light, the pupils read bad print, or write with pale ink, the foundation of near-sightedness is mainly laid, which in fact, is usually developed in those years."

To the adult there may seem some exaggeration in this. The reader is presumedly an adult, or an adolescent, and in his own person may not experience much inconvenience from causes here specified. If you are semisceptical in the matter, reader, remember that the child is under different conditions from yourself. The child must complete certain specified tasks within an assigned time. His eyes are often used without sufficient interruption for hours together. Now, since "variety's the spice of life," there should be frequent interruptions to study. Such variety is as much a necessity to the eye as any other organ. Continued tension unduly exhausts the energy of an organ. The very act of reading could not be endured for longer than a few moments if the eye did not rapidly change its position from letter to letter and from line to line. The more fixed the gaze, and the narrower the field of view, the greater the danger.

Again, if too fine print be injurious to sight, the other extreme of too large print is also fatiguing, because to get over the same amount of matter there must be greater movements of the eye-ball. This is still more the case if the page be wider than usual as it commonly is. Consider the difficulty we have in reading a handbill in which there is a succession of large type. We experience difficulty in such cases in finding the next line. A page with two columns in it is preferable to the same width of page with lines running all the way across. Where double columns exist however the type is apt to be smaller than in a single column. Hence the recommendation of the double column page must be qualified by the size of its type. The distance between the lines should not be less than one-eighth of an inch; and if a double column page be used should be almost double this.

What is known to the printer's craft as "broad-faced" type is preferable to the light-faced. This is because there is a greater contrast between the white paper and the dark letters in the former case. Where the contrast is not so marked, the page must be brought nearer to the eye with all the attendant evils already explained. There is nothing more wearying to an eye than a blurred image always given by faint type or blurred printing. The quality of the ink makes a vast difference.

As to paper, some experiments in Germany go to show that white paper with a slightly yellow tinge is to be preferred. True, there should be as strong a contrast as possible between the letters and the paper, yet there

should be no glare to dazzle the eye. Pure white paper, most commonly used with us, is objectionable if it has any metallic lustre, and especially if it have a bluish tinge.

CONTAGION AND INCUBATION OF DIPHTHERIA.

That the contagiousness of diphtheria should still be doubted is hardly possible, and still the public act as if it did not exist. One of the latest facts is that communicated by Trammar to the annual meeting of the Illinois State Medical Society, on May 18th, 1880 (Med. Rec., June 12th). In one school district, with 59 pupils, an epidemic was started (no cases having previously existed) by two boys who visited a neighboring community where there were cases of the disease. In a few days both boys had symptoms of cold, received some domestic treatment for their little fever and sore throat, and soon returned to school, where other pupils complained of the offensive odor of their breath. Soon other cases appeared, and the number of persons attacked was 58, with 17 deaths.

That diphtheria is contagious is beyond doubt. The contagious element is directly communicated by the patient; it clings to solid and semi-solid bodies, and in this way transmitted even after a long time. There is hardly any disease which can cling as tenaciously to dwellings and furniture; it can be transported by the air, though probably not to a great distance, and hence in houses artificially heated, while the windows and doors are mostly closed, rises from the lower to the upper stories, and it is for this reason advisable to keep the sick on the top floor. It is certainly transmitted by spoons, glasses, handkerchiefs, and towels used by the patient. The contagious character increases directly in proportion to the neglect of proper ventilation.

In regard to the length of the incubation period, there can be no better authenticated facts than those contained in a report of Dr. Elisha Harris to the National Board of Health, an abstract of which is found in No. 1, National Board of Health Bulletin, June 28, 1879. The report says that, in the fourth school district of the township of Newark (Northern Vermont), amidst the steep hills, where reside a quiet people in comfortable dwellings, the summer term of school opened on the 12th of May. Among the twenty-two little children who assembled in the school-room in the glen were two who had suffered from a mild attack of diphtheria in April, and one of them was, at the time school opened, suffering badly from what appeared to have been a relapse in the form of diphtheritic ophthalmia. Besides, it is proved that these recently sick pupils had not been well cleansed, one of them having on an unwashed garment that she had worn in all her sickness three weeks previously.

At the end of the third day of school, several of the children were complaining of sore throat, headache, and dizziness, and on the fourth day and evening so many were sick in the same way that the teacher and officers announced the school temporarily closed. By the end of the sixth day from school opening, sixteen of the twenty-two previously healthy children became seriously sick with symptoms of malignant diphtheria, and some were already dying. The teacher and six of the pupils were not attacked.

Summary.

Diphtheria, therefore, is very contagious. Both the patient and his surroundings, dwelling, furniture, towels, etc., convey the disease. In dwellings it rises to the upper stories with the current of warm air. The poison clings mostly to mucous membranes. Mild cases may communicate serious ones and *vice versa*. The period of

incubation lasts two days or more. It may last a fortnight. Fresh wounds do not require so long to be affected. In these cases the supposition is, that the patient was aleady influenced by the epidemic. Visible symptoms of diphtheria are often noticed after the constitutional ones.—*Sanitarian.*

BOXING THE EARS.

The *Liverpool Post* records an investigation, made by the borough coroner, as to the death of a scholar, aged 13, at Christ Church School, on Christian street. The boy, having been disobedient, and refusing to hold out his hand to be caned, was boxed on the ears by the school-master. This occurred three or four months ago. A few weeks since, the lad, who had previously suffered from deafness, complained of a pain in his ears; and the medical evidence showed that death resulted from long-standing auricular disease. The doctor added that, whilst a blow might have irritated an already sensitive part, it would not have accelerated the boy's decease. The history is by no means clear, nor is the doctor's statement, as here recorded. The jury in giving their verdict of "Death from natural causes" added that, in their opinion, the punishment was administered injudiciously. With this opinion we quite agree. Injuries to the head are always alarming, but when the injury is located so as to affect one of the special senses situated there, it is still more so. Injuries to the eye and ear are particularly to be avoided. These being organs of the utmost importance, consisting of the most fragile tissues, and partly exposed, we would impress upon all the danger of inflicting the slightest corporal chastisement in those regions. A comparatively slight blow on the auricular region, if it happens to compress exactly the column of air in the meatus, may cause a rupture of the drum-head. That this is of not unfrequent occurrence is well known to aurists. We are, however, of opinion that, considering the pressure which the healthy drumhead has been found to resist without rupturing, the membrane which gives way without a blow, has probably not been in a healthy condition at the time of the injury. The suddenness of the blow is also, we believe, an important element. The history given of most of the cases is that the blow was unexpected, and this agrees with the history of ruptures arising from explosions. Artillerymen, for example, who are subjected to explosions of the loudest kind avert any injury to the drum, if they expect the explosion, and prepare for it. Prize fighters suffer from ear affections occasioned during fighting, but rupture of the drum is not so common as inflammation of the auricle and meatus, and tumors of the auricle. In such the blows are, without doubt, much harder, but either from their watching for, and undoubtedly preparing for the receipt of the blow, or from the form of the hand, which at the time that it inflicts such blows, allowing the compressed air to escape better, injuries to the auricle occur more frequently than to the drumhead. Besides injuries to the auricle, meatus, and membrane, injuries to the vestibule and *fenestra ovalis* (parts of the inner ear beyond the drumhead) may occur from blows on the ear setting up pathological conditions which may be quite irremediable. Cases are recorded in which death occurred, but they are rare. We would impress upon all those whose duties may compel them to inflict corporal punishment the necessity of limiting their application to the regions which have ever in England been considered the seats of punishment, and avoiding those in which the pain suffered at the time is not more severe, while the injury inflicted may be far beyond what was contemplated by the giver of the punishment.—*British Medical Journal.*

COMMERCIAL LAW.

By W. M. Sutherland, B. A.

NOTES.

BILLS of Exchange and Promissory Notes form another species of contracts. The chief difference between them is a Bill of Exchange requires three parties, the drawer, drawee and payee, a Note only two, the maker and payee. A Bill of Exchange may be made payable to bearer or order, or to some particular person; in the latter case it is said to be non-negotiable. But, if made payable to order, then it must be endorsed, which is done by the payee writing his name on the back of the bill or note.

The holder is any one of the parties in possession of the bill and entitled at law to receive its contents from another.

All contracts arising on a Bill of Exchange or Draft are simple contracts, but they differ from other simple contracts in one particular—that consideration will be presumed till the contrary appear. The *effect of drawing* a bill payable to a third person is a conditional contract by the drawer to pay the payee, his order or bearer, as the case may be, if the acceptor do not.

The effect of endorsing is a conditional contract on the part of the endorser to pay the immediate or any succeeding endorsee or bearer, in case of the acceptor's or maker's default.

A Promissory Note is an absolute promise in writing, signed but not sealed, to pay a specified sum at a time therein limited, or on demand, to a person therein named, or to his order, or to bearer.

No precise form of words is necessary to the validity either of a Promissory Note or Draft; nor can there be a note by the maker to himself and another person.

A note made by two or more makers may be either joint or joint and several. A note signed by more than one person, and beginning "We promise," is a joint note only, and all the parties must be sued together as one person. A note signed by more than one person, and beginning "I promise," is several as well as joint, and may be sued severally or jointly, and is in reality the several note of each of the makers.

A cheque is an order by a person to his banker to pay a certain sum of money. A banker having in his hands effects of his customer is bound within a reasonable time to pay his customers' cheques, and is liable to an action at the suit of the customer if he do not. He should know his customers' signature, and if he pay a forged cheque he is liable, that is provided there be no laches in the drawing. A person should not accept a cheque in payment of a debt unless the cheque be marked good by a responsible banker, or you feel confident it will be paid when presented.

An I. O. U. is not a note, but merely an acknowledgment of debt.

A note or draft may be endorsed so as to avoid personal responsibility by adding the words "sans recours," or "without recourse to me."

Partners in trade.—The presumption exists that each partner in trade is entrusted by his co-partners with a general authority in all partnership affairs. Each partner by making,

drawing, endorsing, or accepting negotiable instruments in the name of the firm and in the course of the partnership transactions, binds the firm, whether he signs the name of the firm, or accepts in his own name a bill drawn on the firm; but an action cannot be maintained against the firm where a partner has signed his own name only to an instrument, though the proceeds were in reality applied to partnership purposes, unless the name of the signing partner were also the name of the firm. If a partner exceed his authority and pledge the partnership credit on a negotiable security for his own private advantage, his copartners are liable; but if a party taking a bill or note of the firm knew at the time that it was given without the consent of the other partners, he cannot charge them. Articles of agreement between the partners, that no one partner shall draw, accept or negotiate bills of exchange change will not protect the firm against bills drawn, accepted or endorsed in violation of the agreement, unless the holder had at the time of taking the bill notice of the stipulation.

If a creditor constitute a debtor his executor the debt is released and extinguished; because the same hand being at once to receive and pay, the action is at once suspended, hence it follows, that if the holder of a bill appoint the maker or acceptor of an instrument his executor the debt is discharged.

In general a Corporation can contract only under seal.

Bills and notes may be written in any form and in any language, they may be written in pencil as well as in ink.

The signature may be by a mark. A date is not in general essential to the validity of a bill or note, and if there be no date, it will be considered as dated at the time it was made. The time of payment is usually stated at the beginning of the note or bill, but if no time be expressed the instrument will be payable on demand.

The expression *after sight* on a *draft* means after acceptance or protest for non-acceptance, and not after a mere private exhibition to the drawee, for the sight must appear in a legal way. *But* if a *Prom. Note* is made at or after *sight*, the expression merely imports that payment is not to be demanded till it has been again exhibited to the maker, for a note being incapable of acceptance, the word sight must have a different meaning from the same word on a draft.

The sum for which a draft or note is made payable is usually written in the body of the draft, in words at length, the better to prevent alteration, and if there be any difference between the amount in the sum superscribed, the sum mentioned in the body will prevail.

An inaccurate but intelligible statement of the sum payable will not vitiate.

The words value received added to a draft or note are not at all essential, and when added to drafts drawn payable to a third person, are ambiguous.

Bills and notes must be for the payment of money only, and not for the payment of money and the performance of some other act.

The order or promise must be to pay absolutely and at all events, and payment must not depend on a contingency; but it is not material that the time when the event may happen is uncertain, provided it must happen at some time or other.

Bills and notes must be stamped.

It is always desirable for the holder of an unaccepted bill to present it for acceptance without delay, for in case of acceptance the holder obtains the additional security of the acceptor, and if acceptance be refused the antecedent parties become liable immediately. It is advisable too on account of the draw-

er, for by receiving early advice of dishonor he may be better able to get his effects out of the drawee's hands.

But presentment for acceptance is not necessary in the case of a bill payable a certain period after date, but is necessary if the bill be drawn payable at sight, or at a certain period after sight. Till such presentment there is no right of action against any party, and unless it be made within a reasonable time the holder loses his remedy against antecedent parties. This presentment should be made during the usual business hours, and should be to the drawee himself or to his authorized agent.

Acceptance is an engagement by the drawee to pay the bill when due, and is done by writing the word "Accepted" across the face of the draft over the drawee's signature, and may be either unqualified, or it may be conditional.

When a draft or endorsed note matures it must be *presented for payment* if subsequent parties are to be held. A personal demand on the drawee or acceptor is not necessary. It is sufficient if payment be demanded at his residence or place of business, for it is the duty of an acceptor, if he is not himself present, to leave provision for the payment. And it is sufficient if payment be demanded of an agent who has been authorized to pay or has usually paid bills for the drawee.

If a drawee has shut up his house the holder must enquire after him and attempt to find him.

If the drawee be dead presentment must be made to his personal representatives, if he have any, if not, then at his house. Now, however, by Statutory enactment, 37 Vict., Cap. 47, Sec. 1, D., notice of protest may be given where the note is made. Drafts and accepted notes are usually presented for payment on the third day after they fall due. Thus a note falling due on the 4th should be presented for payment on the 7th, that is the third day after the maturity of the draft.

A promissory note payable on demand differs from a draft payable on demand, or a cheque in this respect :— the draft and cheque are intended to be presented and paid immediately, and the drawer may have good reasons for desiring to withdraw his funds from the control of the drawee without delay, but a promissory note, payable on demand, is often intended as a continuing security. If a note be made payable on demand with interest, it need not be presented the next day after receipt, which is the usual time for presenting a draft for payment.

Presentment for payment should be made during the usual hours of business, and if at a bankers', within banking hours. If the party who is to pay the bill be not a banker presentment may be made at any time of day when he may be reasonably expected to be found at his place of residence or business, and even though there be no person within to return an answer.

Where a draft or note was made or accepted, payable at a particular place, it was formerly a disputed point whether a presentment at that place was necessary in order to charge the acceptor, maker or other parties. There are three ways in which a draft may be accepted :—1st, generally, or 2nd, payable at a particular place or bank, or thirdly, payable at a particular bank, and not elsewhere. It is now settled if an acceptor accept payable at a particular place, the draft must be presented there in proper time for payment. If a draft be made payable at a bank, a presentment there will suffice. If a draft be made payable in a particular town a presentment at all the banking houses there will be sufficient; if at one of two towns a presentment at either.

The consequence of not presenting a draft or note is that all the antece-

dent parties are discharged from their liability, whether on the instrument or on the consideration for which it was given. The acceptor or maker, however, continues liable, and indeed presentment is not in general necessary for the purpose of charging him.

Payment should be made to the holder and real proprietor of the draft, for payment to any other party is no discharge to the acceptor, unless the money finds its way into the holder's hands. There are, however, some cases in which payment to a wrongful holder is protected; for instance, if a draft or note either made payable to bearer or order, and in the latter case made payable to bearer by endorsement, be lost or stolen, a *bona fide* holder may compel payment. Not only is the *bona fide* holder protected, but payment to the thief or finder himself will discharge the maker or acceptor, provided such payment were not made with the knowledge of the manner in which the note was obtained, or under such circumstances as would awaken suspicion in a prudent man.

If a draft or note be not payable to bearer, but transferable by endorsement only, and be paid to the wrong party, the payer is not discharged.

Where a draft or note on which some person other than the debtor is liable is expressly given and accepted *in full* satisfaction and discharge, the liability of the debtor for the original debt will not revive if the substituted instrument be not paid. But if it be taken generally on account or in renewal, the original liability of the debtor if the draft or note be not paid revives.

With reference to *principal and surety* it is a general rule of law that a discharge of the principal is a discharge of the surety. What parties to a draft or note are principals and what sureties? Suppose a draft to have been accepted for value. The acceptor is the principal debtor, and the other parties are only sureties for him, liable on his default. For example, suppose a draft to have been accepted, and afterwards endorsed by the drawer and by two subsequent drawers to the holder. As between the holder and the acceptor the acceptor is the principal debtor, the drawers and endorsers his sureties But as between the holder and the drawer the drawer is the principal debtor, and the endorsers are his sureties. As between the holder and the second endorser, the second endorser is the principal, and the subsequent, or third endorser, is his surety. A discharge, therefore, to the prior parties is a discharge to the subsequent parties, the sureties; but a discharge to the subsequent parties, the sureties, is not a discharge to the prior parties, the principals. It follows, therefore, that a discharge to the acceptor is a discharge to all the parties to the draft. So a discharge to an endorser is no discharge of the prior endorsers, but it is a discharge of the subsequent endorsers. The same principles apply to the endorsers of a note.

If the holder once destroy or suspend, or contract to destroy or suspend his right of action against the acceptor the drawer and endorsers are at once discharged, unless the agreement giving time contain a stipulation that the holder shall, in case of default, have judgment at a period as early as he could have obtained judgment if proceedings had continued. If the holder make a void agreement with the acceptor the sureties are not discharged. The taking of a new draft or note, payable at a future day, discharges the endorsers.

When a draft is refused acceptance or payment, it is necessary by the custom of merchants, in order to charge the drawer and endorsers (if any), that the dishonor should be attested by a protest. The protest should be made by a notary public; it is in form a

solemn declaration, written by the notary, stating that payment or acceptance has been demanded and refused, the reason given, and that the draft is therefore protested; and a notice of this protest should be sent immediately or at least not later than the next day after protest, to the parties to be held. It does not require to be in any particular form; it may be written or verbal; all that is necessary is to apprise the party liable of the dishonor of the draft in question, and to intimate that he is to pay it, and an announcement of the dishonor will amount to a sufficient intimation to the endorser that he is held liable. Putting a letter into the post is the most common and the safest mode of giving notice, provided the address be specific and not too general. The consequence of neglect of notice is that the party to whom it should have been given is discharged from all liability.

A deed, bill of exchange, promissory note, guarantee, or any written instrument is avoided by an alteration in a material part, though that alteration is made by a stranger. For a person who has the custody of an instrument is bound to preserve it in its integrity, and as it would be avoided by his fraud in altering it himself, so it is avoided by his laches in allowing another to do it. The alteration of the date is material and would avoid the instrument. Changing the place where it is made payable is a material alteration. Any alteration in the date, sum, or time of payment, the insertion of words rendering negotiable an instrument which before was not so are respectively material alterations and avoid the draft or note. There are, however, two cases in which an alteration, though in part material, will not vacate the instrument: first where such an alteration is made before the bill is issued or became an available instrument; and secondly, where it is altered to correct a mistake and in furtherance of the original intention of the parties.

An alteration by the drawer and payee of a bill or the payee of a note, although it avoids the instrument, does not extinguish the debt, but an alteration by the endorser not only avoids the instrument but extinguishes the debt.

With reference to the time drafts and notes are to be paid, it is a settled fact that they are barred by the statute of Limitation if not enforced within six years after the right of action first accrued. In a note payable a certain time after date the statute begins not when the note is dated but when it falls due. If not renewed either by payment of principal or interest, or by written acknowledgment, as upon a draft drawn at sight, the statute does not begin to run till the draft is presented. Although a draft or note be barred by the Statute of Limitations, yet part payment of principal or interest, or a written acknowledgment of debt followed by a promise to pay, or a written promise to pay, revives the debt.

EXAMINATION PAPER IN ENGLISH ANSWERED.

University of London—Matriculation Examination in English Language, July 3rd, 1880. Morning, 10 to 1.

Examiners: Prof. Henry Morley, Knight Watson, Esq., M. A.

(Not more than ten Questions are to be attempted in addition to the Exercise in Dictation.)

NOTE BY ED.—In order to economize space we have taken the liberty to refer the student to text books in the case of questions that present no special difficulty.

1. Write out and punctuate the passage read by the Examiner. [*Candidates will bear in mind that it is not allowable to make a fair copy of this Exercise in Dictation.*]

2. To what family of languages does English belong? Give any facts shewing its relation to some other language in Europe.

For answer see Mason's Grammar, preliminary notice, or Earle's Philology, section 2.

3. English "*th*ree" is Latin "*tres*," in German "*d*rei." State and explain by examples the law to which a change of this kind is attributed.

For answer refer to Earle's Philology sections 4 and 5, for fuller details than can be given here.

4. How many sounds might possibly be represented by the English alphabet? Classify the actual letters of the alphahet according to their sounds.

The English alphabet, if judged according to the essentials of an alphabet, can properly represent only 21 sounds. Each sign should represent but one sound, and each sound be represented but by one sign. The letters *c*, *j*, *x*, are therefore redundant. *C* has the sound either of *k* or of *s*; *j* is equivalent to *dg*; *x* is sounded like *gs* or *gz* or *ks*. The letters *w* and *y* represent vowel sounds already represented, and are only regarded as consonants from their being more rapidly pronounced at the beginning of words. For the last part of the question refer to Angus's Handbook, section 103.

5. Name and define each of the parts of speech.

This is mere book work, refer to any authorized Grammar.

6. Show how we came by the possessive case in *'s*, and by the plural in *s*. Tell what you know about nouns forming their plurals in *en*.

From the Anglo Saxon genitive case in *ys* or *es* we have the possessive case in *'s*—the apostrophe being used to denote the elision of the vowel. The affix for the genitive case employed in Anglo-Saxon is one which it has in common with nearly all the Aryan languages.

The termination *en* comes from the Anglo-Saxon *an*. The only plurals of this form in regular use are oxen, brethren. Shoon and hosen are no longer used.. Children is a double plural in form, and so is kine. Swine is singular and collective. As regards the origin of the plural in *s*, we may notice that in Anglo-Saxon all nouns of the simplest class formed their plural in *an*, later, *en*. In southern English the forms in *es* began to supersede those in *en*, and later they were used indiscriminately. This is accounted for by the fact that when the Normans began to speak English they made use of the plural affix *s* used in Norman French in pluralizing English nouns. The use of the plural in *s* is then due to the influence of the Norman French. It has been pointed

out by some grammarians that there was a small class of A. S. nouns that formed their plural in *as* before the introduction of Norman French, and that this circumstance may have accelerated the adoption of *s* as the regular plural affix.

7. What is meant by the Infinitive Mood of a verb? Explain as fully as you can the Infinitive form in the phrase: "This house to let."

For the first part of the question see Mason's Grammar, section 189. In the phrase given, the active infinitive is the older and truer form. The phrases "This house is to let," "This house is to be let," are both of them correct, but with a slight difference in meaning. The Passive Infinitive is used when we refer especially to the action indicated by the verb, coupled with a reference to time, as "This house is to be let next week." The Active Infinitive is used when we refer to the quality or simple fact denoted by the verb.

8. Give some account of the different forms of the verb *to be.*

See Mason's Grammar, section 251.

9. Discuss the following past tenses of verbs: *loved*, *taught*, *ate*, *sang*. Tell what you know of the forms *ought* and *must*.

Refer to Earle's Philology or to Mason's Grammar.

10. Discuss any five examples of what is called Irregular Comparison in adjectives. What adjectives cannot properly be used in the Comparative or Superlative degree?

See section 114, Mason's Grammar.

11. Classify the Pronouns.

See section 130, Mason's Grammar.

12. Write two sentences showing the same word used in one as a Preposition, in the other as a Conjunction; also, two sentences showing the same word used as a Preposition and as an Adverb.

13. Make a grammatical analysis of the following sentence: "A step was taken this session which was important in as far as it tended to separate the idea of death-punishment from crimes which were no longer capital."

PROP. A.—"A step was taken this session."
Kind of sentence—Principal declarative.
Subject—"step"
Attributes of S.—"A" and Prop. B.
Predicate Simple—"was taken."
Adverbial Adjuncts—"this session."

PROP. B.—"Which was important in as far."
Kind—Subordinate adjectival, qualifying "step."
Subject—"which."
Predicate Complex—"was important."
Adverbial Adjunct of Complement—"in as far."

PROP. C.—"As it tended to separate the idea of death-punishment from crimes."
Kind—subordinate adverbial, modifying "far."
Subject—"it."
Predicate Simple—"tended."
Adverbial Adjuncts of P.—"as," "to separate the idea of death-punishment from crimes."

PROP. D.—"which were no longer capital."
Kind—subordinate adjectival, qualifying "crimes."
Subject—"which."
Predicate Complex—"were capital."
Adverbial Adjuncts—"no longer."

14. Correct or justify the Syntax of each of the following sentences; and when you correct, tell why you do so:

(a) Art thou proud yet? Ay, that I am not thee.

Incorrect. *Thee* should be *thou*, since it is the predicate nominative after *is*.

(b) Whoever the King favors, the cardinal will find employment for.

Correct. The pronoun *whoever* is indeclinable, and has the same form

for the nominative and the objective case.

(c) Here you may see that visions are to dread.

Contrary to usual idiom. Here you may see that there are visions to dread. For distinction between *to dread* and *to be dreaded*, in this sentence, refer to previous remark on *to let* and *to be let.*

(d) Nothing but wailings was heard.

Correct. The subject of the verb *was heard* is "nothing"; therefore the verb is properly singular.

(e) Neither of them are remarkable for precision.

This idiom has been justified by the usage of some good writers, but in strict grammar the verb *are* should be singular, to agree with its singular subject *neither.*

(f) I cannot tell if it be wise or no.

Incorrect. *No* should be *not*, wise being understood after it.

(g) It must be confessed that a lampoon or a satire do not carry in them robbery and murder.

Incorrect. The subjects are separated by *or*, consequently the verb agrees only with the one next it. The sentence should read "does not carry in it, &c."

(h) Whose own example strengthens all his laws;
And is himself the great Sublime he draws.

Incorrect. The subordinate proposition should not be connected to its principal one by *and*, and it should therefore be omitted. *He* might be supplied before *whose*, though it is not necessary to do so.

ANSWERS TO CORRESPONDENTS.

From J. H. T., Monckton, we have received the following questions:—

1. In Goldsmith's *Traveller*, what is meant by "courts the western Spring," "extremes are only in the master's mind," "with daring aims irregularly great."

Ans.—The first expression is only a poetical way of saying that spring is somewhat earlier in Britain than in the other European countries to east of it. The second expression means that the only extremes to be met with in Britain are those that exist in the minds of the inhabitants. The poet has just said that there are in Britain no extremes of natural scenery. The subdued charms of the landscape are in contrast with the lofty aspirations and turbulent passions of the lords of the soil. The latter expression is admittedly obscure. The adjective *great* may qualify *bosom*, *reason*, *state* or *aims*. It had better be taken with bosom, and then its meaning is quite obvious.

2. In "Lady of the Lake": in Canto 5, stanza 25, "Needs but a buffet, &c." Parse needs in full.

Ans.—According to the view taken of this word by Mr. Armstrong in his Notes on the L. of L. "needs" should be parsed as a verb intransitive, of the weak conjugation, indicative mood, and of the present indefinite tense, and in the singular number and third person to agree with its subject "buffet." This view of *needs* would be justified by its use in the sentence "There are no proofs and there needs none."

3. What is the meaning of "shroud of sentient clay"?

Ans.—A poetical periphrasis for *body.*

From another correspondent (F. S.) we have received the following questions:—

What do you understand by the following phrases which are found in the thirteenth paper of Addison's Sir Roger de Coverley?

"A good Church of England comedy;" "Fearing, lest they should smoke the knight." A comedy in which dissenters are ridiculed. "Smoke," ridicule; consult Worcester's dictionary for the different meanings of smoke.

SCOTT'S NARRATIVE POWER AS SEEN IN THE LADY OF THE LAKE.

By Mr. J. B. Turner.

Prof. Bain in his Manual on Rhetoric, gives the following heads under which the Narrative Power of an author may be treated:

1. The Changes in the Scenes of the Events.
2. The Order of Events.
3. The Concurring Streams of Events.
4. The Explanatory Narrative.

1. *The Changes in the Scenes of the Events.*

In the Lady of the Lake the scenes of the events change more frequently and to a greater extent than we would expect to find occurring in real life. The poet, however, may be excused to a certain extent for these changes, as they seem almost to be forced on him by surrounding circumstances; he has an end to accomplish, and in order to accomplish this end certain changes in the scenes of the event are necessary to the working out of the plot; of these changes, rapidly as they follow one another, the reader is always given timely notice.

2. *The Order of Events.*

The order of events is well preserved throughout the poem. Each incident in the story is dependent on the preceding incidents, and also prepares the mind of the reader for what is to follow. The greatest error which the poet has committed in his order of events, is that he has attempted to crowd so many important events into so short a space of time. Events that would have required weeks or even months he has crowded into the short space of six days.

3. *The Concurring Streams of Events.*

The object of the poet in the Lady of the Lake is to effect a reconciliation between the King and Douglas. In order to accomplish this object, the poet has employed a number of incidents which are so connected with and dependent on one another, as to form an unbroken chain of events which ends with the accomplishment of the object at which he aims.

4. *The Explanatory Narrative.*

It may be laid down as a rule in the narrative that nothing should be introduced that would in any way draw the attention of the reader from the main story and that nothing should be left out that would add to the interest. In this respect Scott has a claim to considerable merit. No doubt some of the minor incidents narrated in the poem might be omitted and the interest of the poem would not suffer to any great extent, but as they serve to relieve the mind of the reader the poet may be pardoned for introducing them. All the main incidents which he has narrated in his poem appear necessary to the working out of the plot and nothing is left out which would have given the story of the poem more finish.

MATHEMATICS.

Solutions to Algebra Paper in last number.

1. See Gross' Algebra, Chap. I.

2. Since any number and the sum of its digits when divided by 9 leave the same remainder, therefore, the number and the number reversed leave the same remainder on being divided by 9, we may therefore suppose

the number $= 9a + r$

and the number reversed $= 9b + r$

$\therefore$ 4 times the No. $= 36a + 4r$

5 times the No. reversed $= 45b + 5r$

the sum of these $= 36a + 45b + 9r$

which is exactly divisible by 9.

This will also be true if the second number instead of being the first number reversed be composed of the same digits in any order whatever; and also if the multipliers instead of being 4 and 5 be any two numbers whose sum is 9.

The same result may readily be shown to hold *mutatis mutandis* for any radix.

3. (1): $b^2 - 1$.

(2). $\left(\frac{xy}{3}\right)^2 - 3\left(\frac{xy}{3}\right) + 3$ by $\frac{xy}{3} + 3$

$= \left(\frac{xy}{3}\right)^3 + (3)^3$

(3). $a^2 + b^2 + c^2 + d^2$.

(4). The expression becomes

$a^2(x+2)^2 - 2a(x+2) + 1$

the square root of which is

$a(x+2) - 1$.

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

4. (1).

1	4	+ 0	+ 5	+ 0 + 1
0		0	0	
−2			−8	0
1				4 0
	4	+ 0,	− 3	+ 4 + 1

$\therefore$ rem. is $-3x^2+4x+1$.

1	− 3	+ 4	+ 1	
0		0	0	
−2			+ 6	− 8
1				− 3
	− 3	+ 4	+ 7	− 11

which is $-\frac{3}{x} + \frac{4}{x^2} + \frac{7}{x^3} - \frac{11}{x^4}$

(2)

1	1				
−1	1	+ 1	0	− 1	− 1
		− 1	− 1	0 + 1	+ 1
	1	+ 1	+ 0	− 1	− 1 + 0 + 1

$\therefore$ the series is $x + x^2 - x^3 - x^4 + x^6 + \&c.$

(3)

2	8	+ 0	− 6	+ 5
−3		− 12	+ 18	− 18
	4	− 6	+ 6	− 13

$\therefore$ rem. is -13.

5. "Book work."

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

(2). 1.

(3). $\frac{1}{(x-1)(x-2)(x-3)}$.

(4). Divide the denominators by

$(x-1)(y-1)$

then the fractions are equal if

$(xy+1+2x)(xy+1+2y)+(x-y)^2 = (x+1)^2(y+1)^2$

which may readily be shewn by expanding both sides, or by factoring thus:

$xy+1+2x)(xy+1+2y)$

$= (xy+x+x+1)(xy+1+2y)$

$= (xy+x+1)(xy+1+2y) + x(xy+1+2y)$

$= (xy+x+y+1)(xy+1+2y) + x(xy+1+2y) - y(xy+1+2y)$

$= (xy+x+y+1)(xy+1+2y) + (x-y)(xy+1+2y)$

similarly $(xy+x+y+1)(xy+1+2y)$

$= (xy+x+y+1)(xy+x+y+1) - (x-y)(xy+x+y+1)$

$\therefore (xy+1+2x)(xy+1+2y) + (x-y)^2$

$= (xy+x+y+1)^2$

$= (x+1)^2(y+1)^2$

7. (1). Let m be the common root, then

$$am^2+bm+c=0 \quad (1).$$
$$pm^2+qm+r=0 \quad (2).$$

Multiply (1) by r, (2) by c and subtract

$$\therefore (ar-cp)m^2 = (cq-br)m \quad (3).$$

again, multiply (1) by p, (2) by a and subtract

$$\therefore (pb-aq)m = ar-pc$$
$$ar-pc = (pb-aq)m \quad (4).$$

Multiply (3) by (4)

$$\therefore (ar-cp)^2 m^2 = (cq-br)(pb-aq)m^2$$

$\therefore$ the condition required is

$$(ar-cp)^2 = (cq-br)(pb-aq)$$

(2). Let m, n be the roots of (1) then $-m$, $-n$ are the roots of (2)

$$\therefore m+n = -\frac{b}{a}, \; mn = \frac{c}{a}$$
$$-m-n = -\frac{q}{p}, \; mn = \frac{r}{p}$$
$$\therefore \frac{b}{a} = \frac{q}{p}. \quad \therefore \frac{a}{p} = \frac{b}{q}$$
$$\text{also } \frac{c}{a} = \frac{r}{p} \quad \therefore \frac{a}{p} = \frac{c}{r}$$
$$\therefore \frac{a}{p} = \frac{b}{q} = \frac{c}{r}$$

8. (1). $x = 2\frac{3}{5}$.

(2). $-1 \pm 2\sqrt{3}$

(3). When cleared of fractions the equation reduces to

$$(1-2x)\sqrt{1+2x} + (1+2x)\sqrt{1-2x} = 2x$$
$$\therefore \sqrt{1-2x}\sqrt{1+2x}(\sqrt{1-2x}+\sqrt{1+2x}) = 2x$$

square both sides.

$$\therefore (1-4x^2)(2+2\sqrt{1-4x^2}) = 4x^2 \quad (1)$$
$$2(1-4x^2) + 2\sqrt{1-4x^2}(1-4x^2) = -(1-4x^2)+1$$
$$\therefore 2\sqrt{1-4x^2}(1-4x^2) + 3(1-4x^2) = 1$$

substitute y for $\sqrt{1-4x^2}$, and we have

$$2y^3+3y^2-1 = 0$$
$$\therefore (y+1)(y+1)(2y-1) = 0$$
$$\therefore y = -1, \text{ or } \tfrac{1}{2}$$
$$\therefore \sqrt{1-4x^2} = -1, \; \therefore x = 0$$

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

$$\therefore x = \tfrac{1}{4}\sqrt{3}$$

or thus; (1) reduces to

$$(1-4x^2)^{\frac{3}{2}} = (6x^2-1$$
$$\therefore (1-4x^2)^3 = (6x^2-1)^2$$

expanding these we get

$$x = 0, \text{ or } \tfrac{1}{4}\sqrt{3}$$

9. $$\frac{x^2(n-1)^2-2x(n-1)^2+(n+1)^2}{x^2(n-1)^2+2x(n-1)^2+(n+1)^2} = p$$
$$\therefore x^2(n-1)^2(1-p) - 2x(n-1)^2(1+p) + (n+1)^2(1-p) = 0$$
$$\therefore x = \frac{1+p}{1-p}$$
$$\pm \frac{\sqrt{(n-1)^2(1+p)^2 - (n+1)^2(1-p)^2}}{(n-1)(1-p)}$$

The num. of this last fraction becomes

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

and in order that x may be real,

$n(n-p)(p-\frac{1}{n})$ must be positive.

$\therefore$ since n is positive, $n-p$ and $p-\frac{1}{n}$ must be both positive or both negative.

$\therefore p$ is either $< n$ and $> \frac{1}{n}$ or $> n$ and $< \frac{1}{n}$ and $\therefore$ always lies between n and $\frac{1}{n}$

10. The H. M. between $H-a$, $H-b$ is

$$\frac{2(H-a)(H-b)}{H-a+H-b} = \frac{2H^2-2(a+b)H+2ab}{2H-a+b} \quad (1)$$

and since $H = \frac{2ab}{a+b}$ $\therefore H(a+b) = 2ab$

$$\therefore (1) = \frac{2H^2-(a+b)H}{2H-(a+b)} = H.$$

11. (1). $d = -\frac{1}{6}$.

$\therefore$ 37th term $= a + 36d = 0$.

sum of 31 terms $= 108\frac{1}{2}$ = sum of 42 terms.

(2). Common ratio $= \frac{3}{5}$

$$\therefore \text{Sum} = 3\tfrac{1}{3}\,\frac{1-(\frac{3}{5})^n}{1-\frac{3}{5}}$$

(3). Common ratio is $-\frac{4}{10}$

$\therefore$ sum to infinity $= \frac{5}{7}$

12. The sum of the first series $= \frac{n}{2}(n+1)$

" " second " $= \frac{n}{2}(3n+1)$

" " third " $= \frac{n}{2}(5n+1)$

∴ sum of all series

$$= \frac{n}{2}(n+1+3n+1+5n+1+ \&c.)$$

$$= \frac{n}{2}(p+n\overline{1+3+5+\ldots})$$

$$= \frac{n}{2}(p+np^2) = \tfrac{1}{2}np(1+np)$$

$$= \tfrac{1}{2}p(n+pn^2)$$

= sum of n such series each continued to p terms.

Toronto University, Pass Algebra, 1st Year, 1861.

1. When are magnitudes in Algebra said to be *positive* or *negative*, and in what sense is a negative quantity said to be less than zero?

If $n > a+b$, then $\frac{1}{n} < \frac{1}{a} + \frac{1}{b}$;

but if $n < a+b$, it cannot be inferred that

$$\frac{1}{n} > \frac{1}{a} + \frac{1}{b}.$$

2. Investigate Horner's method of division and apply it to divide $5x^5 - 3x^2 + 1$, by $x^2 - 2x + 3$, exhibiting both the complete remainder and the continuation of the quotient in descending powers of x.

3. If in $f(x)$, a rational and integral function of x, there be substituted $px + q$ for x^2, wherever x^2 occurs either singly or as a factor in some higher power of x, till the expression is reduced to the form $Ax + B$, in which A and B do not involve x, then $Ax + B$ will be the remainder after the division of $f(x)$ by $x^2 - px - q$.

Shew that

$(x^2-1)(x-2) + (x^2-x+1)^2 + (x2+x+1)^2$

leaves the same remainder whether divided by $x^2 - x + 1$, or by $x^2 + x + 1$.

4. Investigate a rule for finding the highest common divisor of two algebraic quantities.

Find that of

$x^2y + xy^2 - 3x^2 + 3y^2 - 9x + 9y - 2y3$

$x^2y + 2xy^2 + x^2 + 4xy - 5y^2 + 2x - 2y - 3y3$

and examine the case of $y = 1$.

5. Prove that if n be 0, 1 or 2 the following have a common divisor:

$x^n(a-y)(b-y) - y^n(a-x)(b-x)$;

$a^n(x-b)(y-b) - b^n(x-a)(y-a)$.

6. Shew what changes may be made in the numerator and denominator of a fraction without altering its value.

If $\frac{a}{b} = \frac{c}{d}$ then will $\frac{a+c}{b+d} = \sqrt{\frac{ac}{bd}}$.

7. If $\frac{a}{b}$ and $\frac{c}{d}$ be not equal, then $\frac{a+c}{b+d}$ and $\sqrt{\frac{ac}{bd}}$ lie between them in magnitude, and $\frac{a+c}{b+d}$ will be greater than $\sqrt{\frac{ac}{bd}}$ except when $\frac{a}{c}$ lies between $\frac{b}{d}$ and $\frac{d}{b}$; a, b, c, d being positive quantities.

8. "If three magnitudes are continued proportionals, the ratio which the first has to the third is said to be the duplicate of that which the first has to the second."—(Euclid B. V.) From this definition shew how to express algebraically the duplicate ratio of two quantities.

Of the ratios $a:b, c:d, e:f, \ldots\ldots y:z$, each is the duplicate of that which follows; find the relation connecting the magnitudes a, b, y, z.

9. When is one quantity said to vary as another? If a varies as $\sqrt{b}$ and c^2 varies as $b3$ then will ac vary as $b2$?

10. What is meant by a root of an equation? Prove that a quadratic equation can only have

two roots. Must it always have two?

What are the roots of $x + \frac{1}{x} = 2$?

11. Find the conditions that the roots of the equation $ax^2 + bx + c = 0$ may be positive integers.

12. Find the arithmetic, geometric and harmonic means between two given quantities.

For examples, between 2 and $\frac{1}{2}$, and between -2 and $-\frac{1}{2}$.

13. If A G H be the arithmetic, geometric and harmonic means between a, b, then will

$$\frac{H}{A} = 1 + \frac{(H-a)(H-b)}{G^2}$$

14. Having given the first and last of n quantities in arithmetic progression, find their sum.

There being 49 terms, of which the first is 200 and the last -100, find their sum and the middle term.

15. Given the last term l, the sum s and the common difference d construct the series.

Shew that there will be two distinct series, provided the following conditions hold:

(1). d and s have the same sign;

(2). $(2l + d)^2 - 8ds$ is finite and a complete square (z^2 suppose);

(3). $2l + z$ and $2l - z$ each an odd multiple of d. And when this is the case, if a, b be the first terms in these two series, then will $a + b = d$.

16. In a geometric series, given the first term, the common ratio and the number of terms, find the sum; and when the common ratio is a proper fraction find the limit to which the sum approaches as the series is continued indefinitely.

Find the sum to n terms, of

$$\frac{2}{3} - 1 + \frac{3}{2} - \frac{9}{4} + \ldots.$$

and *ad infinitum* of

$$\frac{3}{2} - 1 + \frac{2}{3} - \frac{4}{9} + \ldots.$$

17. If the common ratio r in a geometric series, whose first term is 1, differ but little from unity, an approximation to the sum of n terms will be furnished by

$$s = n + \frac{n\overline{n-1}}{2}\overline{r-1}$$

and a still closer approximation will be

$$s + \frac{n-2}{3}\overline{s-n}.\overline{r-1}$$

18. Solve the equations:

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

(2). $(ax+b)(px+q) = (bx+a)(qx+p)$

(3). $x^2 - 111\frac{112}{121} = 11(x+11) + \frac{18}{121}$

(4). $xy(x^2+y^2) = a$

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

19. Find the time between successive transits of the minute hand over the hour hand of a common clock.

20. The opposite sides of a rectangle are each increased by a length a, and the other two sides each diminished by b, and the area is found to be unaltered; but if these changes in the sides had been respectively c, d, the area would have been diminished by e. Find the sides and examine the nature of the problem when $ad = bc$ and $bc + e = cd$.

SOLUTIONS TO PROBLEMS FROM CORRESPONDENTS.

NOTE.—*When a solution to a problem sent does not appear, the sender will confer a favor by repeating the problem.*

1. What must be the least number of soldiers in a regiment to admit of its being drawn up 2, 3, 4, 5 or 6 deep and also admit of its being drawn up in a solid square?

To admit of being drawn up 2, 3, 4, 5 or 6 deep the number must be a multiple of each of these numbers, and $\therefore$ must be at least 60. Also, since every square number contains each of its simple factors an even number of times, therefore, this number must contain 2, 3, 5 each an even number of times, and therefore must contain 4, 9 and 25, and hence must be at least 900.

2. A man is supposed to be standing on the end of a car with a revolver in his hand; providing he shoots straight could he possibly shoot a man standing on the other end of the car, if it be going at the same rate as the bullet?

(1). Suppose the man with the revolver stands on the rear end of the car and shoots forward. Let the rate of the car be a miles an hour; then the bullet must also be moving at the rate of a miles an hour before the shooting takes place. If the bullet then leaves the revolver at the rate of a miles an hour it will then have a total velocity of $2a$ miles an hour, and will therefore overtake the man at the other end at the rate of a miles an hour; that is, at the same rate as when the car is not in motion.

(2). Suppose the positions reversed; then the velocity given to the bullet by the discharge is just sufficient to destroy the velocity it had on account of the motion of the car, and the bullet is consequently brought to rest; and since the victim is moving forward a miles an hour the bullet is approaching him at the same speed as before.

3. If two spheres of radii a and b touch each other internally, find the distance of the center of gravity of the solid contained between the two surfaces from the point of contact.

The volume of the inner sphere is

$$= \frac{4}{3} \times \frac{22}{7} \times b^3, \quad (1)$$

that of the outer $= \frac{4}{3} \times \frac{22}{7} \times a^3$, (2)

$\therefore$ volume of the solid between the surfaces

$$= \frac{4}{3} \times \frac{22}{7} \left(a^3 - b^3 \right); \quad (3)$$

And if the weight of a unit of volume be taken as the unit of weight (1), (2) and (3) will represent the weights as well as the volumes.

Let x be the distance required.

Then the moment of (3) about the point of contact is

$$\frac{4}{3} \times \frac{22}{7} \left(a^3 - b^3 \right) x, \quad (4)$$

And the moments of (1) and (2) about the same point are respectively

$$\frac{4}{3} \times \frac{22}{7} b^3 \times b, \quad (5)$$

$$\text{and } \frac{4}{3} \times \frac{22}{7} a^3 \times a. \quad (6)$$

and since the moment of the whole sphere about this point is equal to the sum of the moments of its two parts about the same point, therefore the sum of (4) and (5) is equal to (6).

$$\therefore (a^3 - b^3) x = a^4 - b^4$$

$$\therefore x = \frac{a^4 - b^4}{a^3 - b^3}.$$

4. If P be the continued product of n quantities in Geometric progression, S their sum and R the sum of their reciprocals, show that

$$P^2 = \left(\frac{S}{R} \right)^n$$

Let $S = a + ar + ar^2 + \ldots$

Then $R = \frac{1}{a} + \frac{1}{ar} + \frac{1}{ar^2} + \ldots$

$$= \frac{1}{a^2 r^{n-1}} \left(a + ar + ar^2 + \ldots \right)$$

$$= \frac{1}{a^2 r^{n-1}} S$$

$$\therefore \frac{S}{R} = a^2 r^{n-1}$$

$$\therefore \left(\frac{S}{R} \right)^n = a^{2n} r^{n(n-1)}$$

$$P = a \times ar \times ar^2 \times \ldots$$

$$= a^n r^{1+2+3+\ldots+n-1}$$

$$= a^n r^{\frac{1}{2}n(n-1)}$$

$$\therefore P^2 = a^{2n} r^{n[n-1]}$$

$$\therefore P^2 = \left(\frac{S}{R} \right)^n$$

5. If $a^3 + 8c = 4ab$ and $a^2 d = c^2$ show that $4bcd = 8ad^2 + c^3$

since $a^2 d = c^2$

$\therefore a^4 d^2 = c^4 = a^2 d c^2$ (1)

(The square of each of two equal quantities is equal to their product)

$\therefore$ multiplying the terms of

$$4ab = 8c + a$$

by the equal quantities (1) we get

$$4aba^2\,dc^2 = 8ca^4d^2 + a^3c^4$$
$$\therefore 4bcd = 8ad^2 + c^3.$$

6. Solve the equation

$$2x^3 - x^2 - 2x + 1 = 0$$

add x^4 to both sides

$$\therefore x^4 + 2x^3 - x^2 - 2x + 1 = x^4$$
$$x^2 + x - 1 = \pm x^2$$

taking the upper sign $x = 1$

while the lower gives

$$2x^2 + x - 1 = 0$$
$$\therefore x = -1\tfrac{1}{2}$$

7. Explain how to assert the *two* equalities $a = b$ and $x = y$ in *one* statement.

This may be done in two ways

$$a + x\sqrt{-1} = b + y\sqrt{-1}$$

or $(a - b)^2 + (x - y)^2 = 0$.

Two straight lines are drawn to the base of a triangle from the vertex, one bisecting the vertical angle and the other bisecting the base. Prove that the latter is the greater of the two lines.

Let ABC be the triangle; describe a circle about ABC; bisect BC in D; draw DE at right angles to BC meeting the circle in E, (E and A being on opposite sides of BC) and join EA cutting BC in F. Then since the arcs BE, EC are equal, therefore the angles BAE, CAE are equal, that is, EA bisects the angle BAC. Join AD; then the exterior angle AFD of the triangle DFE is greater than FDE, that is, greater than a right angle, therefore ADF is less than a right angle and therefore AD is greater than AF.

Or thus: AD, DE are together greater than AE, and FE is greater than DE, therefore *a fortiori* AD is greater than AF.

The following brings the problem within the range of Book I. Suppose AC greater than AB; draw AF bisecting BAC, meeting BC in F; draw BH perp. to AF and produce it to meet AC in G, then H is the middle point of BG, and D is the middle point of BC ∴ HD is parallel to GC ∴ AH, CD join the extremities of the parallel lines AC, HD towards the same parts ∴ AH, CD meet only when produced, ∴ the point F is in BD and not in DC. Then since AC is greater than AB ∴ the angle ABC is greater than ACB ∴ AFC, being equal to ABC and half A, is greater than AFB which is equal to ACB and half A ∴ AFD is an obtuse angle and ∴ greater than ADF ∴ &c.

That F falls on the side of D opposite the greater side appears at once from Book VI. prop. 3, for if CA is greater than AB, CF must be greater than FB.

If the parallelogram of which AB, AC are adjacent sides be completed, then AD produced will be a diagonal, and therefore nearer the greater side, and consequently the line bisecting BAC will be between AD and the shorter side of the triangle.

GENERAL HINTS ON THE SOLUTIONS OF DEDUCTIONS.

Before proceeding to the actual solution of deductions, it will be well to pay careful attention to two or three points upon which all satisfactory and sound work must be based. And above all others, at the root of all lies *accurate definition*—that is to say, to be able accurately to describe any geometrical figure or operation, and to fully appreciate such definition when heard or read, so as to grasp at once the various and possibly complicated ideas involved in it. For definitions and descriptions may err either through excess or defect—that is to say, facts may be stated which are not to the point, or which are really included in what has been otherwise mentioned; or, on the other hand, some really pertinent fact may be omitted, so that the description only partially defines the figure or operation referred to, for it would equally suit one that differed from it in that very peculiarity. Consider, for instance, the definition of a square: if we described it as a four-sided figure whose angles are right angles, we should err by defect, for we have not stated that it is a rectilineal figure, so that one of the sides might, as far as our definition is concerned, be curved; nor yet have we stated that its sides are equal, both of which

statements are necessary to define a square. Again, to describe a square as 'a quadrilateral rectilinear figure whose sides are equal and its angles right angles,' is to err slightly in excess; for if any two adjacent sides be equal and its angles right angles, or its sides be equal and *one* angle be a right angle, our definition will be suited by the square and by no other figure. And this is just what a definition should do—it should describe the object or operation referred to, and no other, and should only state what is entirely necessary. As an instance of inaccurate definition of an *operation*, suppose we intend to describe upon a given line a triangle equal in all respects to another, it would be saying too little if we said that two sides of the one were to be equal to two sides of the other, each to each, for it is also necessary that the angle between them should be equal, or that the third side should be equal. Similarly, we should be erring in excess if we said that two angles and two sides should be equal, since it is ample to say that two angles and one side should be so. Similarly, an equilateral pentagon is not necessarily regular, nor yet is an equiangular pentagon so; only a pentagon at once equilateral and equiangular answers the definition of a regular pentagon.

Having thus noticed what are the requirements of an accurate definition, it is necessary both to use carefully our words when defining any figure or operation, and also to examine carefully the terms in which any problem or theorem is presented to us, making sure that in our treatment of the question we really use up all the facts stated, or otherwise the proposition that we are attempting may not be true or possible, in consequence of our having omitted some material consideration. For every proposition contains certain *data*, or things granted and certain *quæsita*, or things required to be constructed or proved. Now, unless we comprehend accurately both of these, there can be little hope of a successful result. For instance, in Book I, Prop. 47, the data are that the triangle is right angled, and that the figures described on its sides are squares, and therefore have their sides equal, and their angles, as we have learned, all right angles; each of these three facts is material to the proof, and if one of them had been overlooked the proof would have failed. Similarly, the thing required to be proved is that the square on the hypothenuse is equal to the sum of the other two; any inaccuracy in stating this would really alter the object of the whole proposition. A very common instance of false definition, or of false comprehension of a statement, is to fancy that because in two triangles two sides of the one are equal to two sides of the other, each to each, and that one angle of the one is equal to one angle of the other, that therefore the triangles are equal, which is not true except when the equal angles are those between the pairs of equal sides, as in Book I, Prop. 4.

This brings us to a consideration of the next point of vital importance, and that is *accurate reasoning*. This is generally regarded as the object of *logic*, which names and explains the various errors to which argument is liable, and shows how to avoid them; but in mathematical reasoning the subject is so clear, and the terms so accurately defined, that no careful and intelligent student should ever be in doubt as to whether a piece of reasoning is sound or unsound. For example, in the proof of a proposition, he should ask at each step. Why is this true? If the answer be 'by hypothesis,' he should examine the hypothesis and see if the given statement be really there; if the answer be 'by construction,' he should examine the construction to see if he have really so constructed the figure; if the answer be that the step depends upon any definition, axiom, or previous proposition, he should see that it really is not merely dependent on, but a necessary result of that axiom or proposition. A very little practice and careful attention will at once enable any one to detect a fallacy in geometrical reasoning.—'*Euclid*,' *in Stewart's Mathematical Series.*

SCIENCE DEPARTMENT.

(*Continued from page 120.*) MISS L. E. BRYANT.

TESTS.

I.—HYDROXIDES.

Properties given in the digest.

II.—NITRATES AND CHLORIDES.

CA.	SR.	BA.	MG.
$Ca(NO_3)_2$, $CaCl_2$ } Soluble in alcohol, and deliquesce in air.	$Sr(NO_3)_2$ } Soluble in alcohol and deliquesces in moist air. $SrCl_2$ } Insoluble in alcohol, does not deliquesce in air.	$Ba(NO_3)_2$, $BaCl_2$ } Insoluble in alcohol, and do not deliquesce in air.	

III.—CARBONATES.

A soluble Carbonate Na_2CO_3 gives white precipitates with Salts of these metals.

$CaCO_3$, the bulky prec., when heated assumes the crystalline form. Is pretty readily soluble in solution of Ammonium Chloride.	$SrCO_3$ is less soluble in Ammonium Chloride than $BaCO_3$.	$BaCO_3$ slightly soluble in Ammonium Chloride.	The basic Magnesium Carbonate, $MgCO_3'' + Mg(OH)_2$, is not precipitated if Ammonium Chloride or other similar Ammonium Salts be present in sufficient quantity.

IV.—SULPHATES.

Soluble Salts with Sulphuric Acid, H_2SO_4, give white precipitates.

$CaSO_4 + 2H_2O$ is immediately produced in highly concentrated solutions. A large proportion of water dissolves it. It dissolves readily on boiling in a concentrated solution of Ammonium Sulphate, $(NH_4)_2SO_4$. No prec. in dilute solutions.	$SrSO_4$. At first amorphous, then crystalline—more soluble in water than $BaSO_4$ —insoluble in alcohol — perceptibly soluble in HCl or HNO_3.	$BaSO_4$ (blanc fixe), only perceptibly soluble in boiling concentrated solutions of HCl or HNO_3 or in concentrated solutions of Ammonium Salts, when an excess of Sulphuric Acid or a Sulphate is present.	No prec.

V.—HYDROFLUOSILICIC ACID, H_2 Si Fl6.

Throws down..

No precipitate, even when an equal volume of alcohol is added.	No prec., even in concentrated solutions. Precipitation only takes place in highly concentrated solutions upon addition of an equal volume of alcohol.	A colored crystalline prec. of Barium Silico Fluoride, Ba Si Fl6 An equal quantity of alcohol hastens and perfects precipitation.	No prec.

VI.—HYDROGEN SODIUM PHOSPHATE, $HNa_2 PO_4$.

Throws down..

White prec. of HCa PO_4 or Ca_3 2(PO_4)—in solutions of Calcium Sulphate, Ca SO_4, when the phosphate is neutral or alkaline. Soluble in acids, even acetic acid, also in NH_4 Cl.	Same as Barium.	A white prec. of Hydrogen Barium Phosphate HBa PO_4 out of neutral or alkaline solutions. Free acids dissolve it.	Hydrogen Magnesium Phosphate HMg PO_4 + 7H_2 O as a white powder (if Magnesium solutions be not too dilute) which upon boiling becomes Mg_3 (PO_4)$_2$ + 7H_2 O. If before the addition of the precipitant, Ammonium Chloride and Ammonia be introduced, Ammonium Magnesium Phosphate, NH_4 Mg PO_4 + 6H_2 O, as a white crystalline prec:, will be thrown down, even in very dilute solutions. This prec. is insoluble in water containing Ammonia, and it is in this form that Magnesium is quantitatively determined.

VII.—AMMONIUM OXALATE.

$(NH_4)_2\ C_2\ O_4$ precipitates white..

Calcium oxalate, $Ca\ C_2\ O_4\ 2H_2\ O$, in concentrated or hot solutions. In dilute and cold solutions gives a prec. more distinctly crystalline after some time. Insoluble in acetic and oxalic acids, soluble in HCl, HNO_3.	Same, readily soluble in HCl, HNO_3. Sparingly soluble in oxalic and acetic acid.	Crystalline Barium oxalate $Ba\ C_2\ O_4\ H_2\ O$, soluble in HCl and HNO_3, also in oxalic and acetic acids when recently thrown down, Barium binoxalate $(C_2\ O_4\ H)_2\ Ba + 4H_2\ O$, separating out speedily in the form of a crystalline powder.	Magnesium oxalate, $Mg\ C_2\ O_4 + 2H_2\ O$, in highly concentrated solutions. Ammonium chloride and free Ammonia hinders the formation almost completely. In highly dilute solutions, nothing.

VIII.—POTASSIUM CHROMATE, $K_2\ Cr\ O_4$,

or Bichromate $K_2\ Cr_2\ O_7$ throws down..

No prec.	No prec., even when concentrated.	A bright yellow prec. of Barium chromate $Ba\ Cr\ O_4$. Dissolves readily in HCl or HNO_3 to a yellowish red solution, from which it is again precipitated by Ammonia.	No prec.

IX.—FLAME.

Salts on Plantinum Wire color Bunsen Gas Flame..

Yellowish red color. Compounds of Calcium with fixed acids are tipped with HCl. Flame viewed through blue glass appears *faint greenish gray* colored; through green glass, finch green. Difference between Sr and Ca.	Intensely red color. Sample is moistened with HCl. Viewed through blue glass, appears purple or rose; through green glass, faint yellow.	*Yellowish green.* Soluble Barium Salts give this coloration immediately. Phosphate must be moistened with HCl or $H_2\ SO_4$ and Silicate fused with Sodium Carbonate to give the reaction. Viewed through green glass, appears *bluish green.*	No coloration of flame.

X.—SPECTRA.

The intensely green line β, the intensely orange line α, and an indigo blue line to the right of G, in Solar Spectrum.	An orange line α, the red lines β and γ, and the blue line δ.	A number of green lines—α and β most intense, F less marked.	No Spectrum.

QUANTITATIVE ANALYSIS.

Magnesium may be separated from the other metals of this group by means of Ammonium Carbonate, with the addition of some Ammonia and Ammonium Chloride, and the application of heat. Calcium, Strontium and Barium Carbonate fall, and may be separated from the Magnesium by filtration. If to the filtrate, which contains all the Magnesium, Ammonia and Sodium Phosphate be added, Ammonium Magnesium Phosphate, $NH_4\ Mg\ PO_4$ separates out after 12 hours' standing, and may be filtered. The filter is washed with Ammonia water, dried, and heated in a crucible. Ammonia and water are driven off and Magnesium Pyrophosphate remains, and can be weighed.

$2\,NH_4\ Mg\ PO_4 = Mg_2\ P_2\ O_7 + 2NH_3 + H_2\ O.$

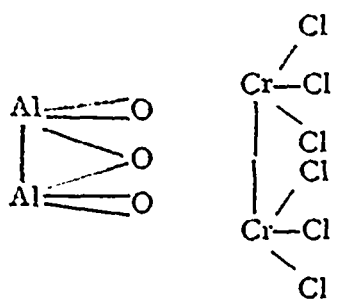
If the Calcium, Strontium and Barium Carbonates be dissolved in dilute Hydrochloric or Nitric Acid and Sulphuric Acid added, $Ba\ SO_4$, $Sr\ SO_4$ and traces of $Ca\ SO_4$ are precipitated. The free acid is removed by Ammonia (until Ammonia is smelt), vessel cooled, Ammonia Carbonate added, and the whole allowed to stand several hours. The Sulphuric Acid of Strontium and Calcium is replaced by Carbonic Acid, and Strontium and Calcium as Carbonates are precipitated. The three are now brought into a becher glass and Nitric Acid added. Strontium and Calcium Carbonate dissolve, Barium Sulphate remains, may be filtered, dried and weighed. The filtrate containing $Ca\ (NO_3)_2$ and $Sr\ (NO_3)_2$ is evaporated to dryness, the residue pulverized and digested for a considerable time with absolute alcohol, to which a little ether has been added, in a basin over warm water (without heating). Calcium Nitrate dissolves, leaving Strontium Nitrate undissolved. In filtering the $Sr\ (NO_3)_2$ care must be taken not to wash with water, but with a mixture of alcohol and ether. The Strontium Nitrate on filter is dissolved in water, Sulphuric Acid added, and $Sr\ SO_4$ precipitated, dried and weighed. The alcoholic solution of $Ca\ (NO_3)_2$ is carefully evaporated until alcohol and ether are removed, Ammonia and Ammonium Oxalate added, and Calcium Oxalate $Ca\ C_2\ O_4$ precipitated. This when dried at 100°C and heated in crucible, passes into the Carbonate $Ca\ CO_3$ and may be weighed, &c.

GROUP III.

METALS—ALUMNIUM AND CHROMIUM.

By —— Thomas.

PROPERTIES OF THE GROUP.—The metals of this group give with Ammonium Sulphide, $NH_4\ HS$, in salts in which they constitute the base, not the Sulphide, but the Hydroxide, $Al_2\ (OH)_6$, $Cr_2\ (OH)_6$, of the metal. Ammonia produces the same reaction. Sulphuretted Hydrogen $H_2\ S$ forms no precipitate, their Sulphides not being obtainable in a moist way. The Oxides and Hydroxides are insoluble in water. Apparently they are trivalent, really quadrivalent, the two tetrad atoms, Al_2 and Cr_2, forming a sexivalent group.



I.—SYMBOL.

Al. C. W. 27.3 S. G. 2.6, Cr. C. W. 52.4, S. G. 6. S.

II.—OCCURRENCE.

AL.

Not free, but combined (1) with Oxygen in Corundum, Ruby, Sapphire, Emery, $Al_2\ O_3$; (2) with Silicon and Oxygen in Feldspar and other Silicates, and in Clay, Marl, Slate, &c.

CR.

Not free, but combined (1) with Iron and Oxygen in Chrome-iron Stone, Chromite FeO, $Cr_2\ O_3$; (2) with Lead and Oxygen in Lead Chromate, Krokoite, $Pb\ Cr\ O_4$.

III.—PREPARATION.

The vapour of Aluminium Chloride is passed over metallic Sodium.

(1). The Oxide is reduced by charcoal at a very high temperature.

(2). The Chromic Chloride is reduced by melting Zinc.

(3). The Chromic Chloride is reduced by Sodium.

IV.—PROPERTIES.

Silver white metal, with bright metallic glance, very ductile and malleable, S. G. 2.6, —conducts electricity eight times better than iron—melts at a red heat somewhat easier than silver, and upon cooling becomes crystalline, not oxidized in the air at the common temperature, decomposes water at 100°C only when in the form of a very fine powder and then but slowly—is little effected by dilute acids with the exception of Hydrochloric Acid, in which it easily dissolves, evolving hydrogen—soluble also in alkalies, &c.

On account of its lightness and bright lustre it is used for the metallic portions of optical instruments, as well as for ornamental work.

Pure Chromium is the most infusible of all the metals, only melting at a temperature sufficient to fuse and volatilize Platinum.

The properties of Chromium vary according to the method of preparation. Prepared after the first way it is a steel gray metal—more difficultly fusible than Platinum, very hard, easily soluble in HCl and but little effected by H_2SO_4 and HNO_3; second way, it is a bright, grey powder, consisting of little rhomboedral crystals, which, when heated in the air become yellow and blue, (like steel), and are gradually covered by a coating of Chromic Oxide—heated in pure Oxygen it burns, emitting sparks—is easily soluble in HCl, also in H_2SO_4—is not effected by HNO_3; third way, it forms bright crystals of the cubic system, which resist the action of all acids, even of a *qua regia*.

PUBLIC SCHOOL DEPARTMENT.

GRADED COURSE OF INSTRUCTION.

FIRST GRADE.

Division A. (Lowest Class.)

READING WRITING AND SPELLING.

The first 15 pages of First Book, part I.

Requisites.—A book, slate and pencil for each pupil, for seat preparation; tablet lessons, black-board and chalk, for recitation.

How to teach.—On the first tablet call the class's attention to OX and encourage the pupils to point other OX's on the tablet; then call attention to ON, comparing it with OX, and encourage them to point out the difference; then take up NO in the same way. Do not trouble the pupils with the *names* of any of the letters till the *words* of the lesson are thoroughly mastered. Print the words on the board and encourage the pupils, each with a piece of chalk, to imitate. Let the pupils go to their seats and with their books, slates, and pencils, practice printing what has been taught.

When the first tablet is thoroughly mastered take up the second, teaching the *words* first, afterwards the *letters* composing them. When five tablets are mastered change the *printing* to unjoined *script*. Reproducing the lesson on slates at the seat affords employment for idle hands and teaches spelling in the only rational way. See at the very outset that the pencil is held properly.

ARITHMETIC.

Counting and Adding.—Counting to 20; adding any of the first three digits to another.

Requisites.—Numeral Frame, slate, pencil and black-board.

How to teach.—The child's knowledge of numbers commences with counting objects. The Numeral Frame is the most convenient apparatus to aid in teaching counting, and in giving children first ideas of simple numbers. At first the counting should not extend beyond 10. When all the balls on each wire have been counted, then proceed to move one ball on each wire and let the class count to ten as before; let this exercise be continued from day to day until each pupil can count from 1 to 10 alone. Afterwards, the counting may be extended to 20 by moving the balls on two wires; to 30 by moving the balls on three wires, and so on. The Numeral Frame should be used in teaching addition; first move 2 balls at a time, and thus teach them to add by *twos*; thus two, four, six, eight, &c. After the pupils can write the numbers to 20 on their slate, the teacher should write a column of 2's on the black-board, and teach the class to add the figures in the same way as the balls were added; then give them columns of figures (involving the integers 1, 2 and 3 only) on their slates to add. Practice all the addition combinations to 3. Observe the order—frame, black-board, slates.

DRAWING.

This should be introduced in such a manner as to give an interesting variety to the class work, and to give the pupils something *to do* that will interest them when they have become tired with their other lessons.

N. B.—The exercises of this grade should not be continued upon the same subject longer than 15 minutes at one time; or the manner of the exercise might be changed. If the teacher does not furnish the needed employment and changes of position by variety in his methods of instruction, the pupils will seek to gratify their needs by play; they should not be compelled to sit without employment, either for the mind, the hands, or the body. The secret of maintaining good discipline lies in furnishing regular and constant occupations to all the members of the class. Changes in the manner of conducting the exercise of a single lesson will be useful to the teacher toward the attainment of this aim: frequent alterations from answers by individual pupils to responses by the entire class will be found advantageous in maintaining attention of all the pupils.

OBJECT LESSON.

Form.—Common shapes, as square, oblong, ball, cube. Select the form to be taught and lead the pupils to observe it, then tell them its name; next require them to mention other objects having the same shape.

Color.—Pupils should be led to distinguish resemblances and differences in color (from colored cubes, balls or cards,) and to group together objects of like colors. They should also learn the names of the six principal colors.

Objects.— The lessons on common objects should be simple and conversational. The pupil should be led to notice and point out the principal parts, and encouraged to tell what they see and what they know of each object shown them.

Division B.

READING, WRITING AND SPELLING.

All of First Book, part I, the first fifteen pages being review.

How to teach.—On tablet No. 12 call class's attention to new words; pronounce them and have the class pronounce after you; read in phrases and have the class imitate you in word and expression. Let the class go to seats and on slates copy from their books, in joined script, the whole lesson. They are then ready to recite. When reciting, you read from the tablet with proper expression, and have the pupils, reading from their slates, imitate you. They, reading their own work, will read better and learn faster than in any other manner; and reproducing the lesson on the slates will teach writing, spelling, points and capitals most effectually; besides it affords a useful employment for the little hands that might otherwise be in mischief. See to the proper holding of the pencil.

ARITHMETIC.

Counting to 50; adding with objects and with figures; twos, threes, fours and fives as in Division A; subtraction of one two or three from any of the first five digits.

How to teach:—Addition and subtraction should be taught first from the frame or objects, then on the blackboard and lastly on the slate. Follow the directions accompanying the addition and subtraction tables (Johnson's tables.)

DRAWING.

Same as in last limit. The teacher should give full illustrations on the blackboard, relating to each point and step of the lesson.

OBJECT LESSONS.

Form:—Common shapes continued. Circle, semicircle, square, oblong, triangle. See directions for Division A.

Color:—Same as last limit.

Objects:—Expansion of last limit.

Division C.

READING, WRITING AND SPELLING.

First twenty-nine pages of First Book, part II.

How to teach:—See that all have acquired the habit of reading in a talking tone of voice. In class preparation pronounce and explain the different words. Read the lesson yourself with proper expression and have the pupils imitate. *Always* read in phrases, not: "Two—dogs—Tray—and—Snap—went—out—to—walk," but: "Two dogs—Tray and Snap—went out—to walk. Tray—was a good dog—but" etc. Of course the pauses between the phrases must not be *too* marked. Let the class go to seats, copy the lesson in script letters on their slates, leave their books at their seats, bring their slates to the class and read from them. Capitals, principal points, spelling, writing, reading and useful employment are secured in their perfection in this way. Continue the same plan in all the succeeding grades. In dictation, dictate in phrases, even if you give two or three phrases at a time.

ARITHMETIC.

Notation and numeration to 100. Addition and subtraction table to 10 inclusive. Simple practical questions in mental arithmetic, involving addition and subtraction of the limit.

DRAWING.

Same as in Division A.

OBJECT LESSONS.

Form:—Review of former limit; cylinder, cone, pyramid.

Color:—Same as for Division A.

Objects:—Same subjects as in Division A., but more enlarged.

SECOND GRADE.

(Time allowed—about 5 months.)

READING, WRITING AND SPELLING.

All First Book, Part II, the first 29 pages being review.

How to teach.—See remarks under first grade. Call attention to words of the same sound but different spelling and meaning that occur in the lesson. Encourage the pupils, after reading a sentence, to give in their own words the gist of it. Recitations will be found of great help in securing the all-important *talking tone of voice*. Always read from the slates.

1st. Train the pupils to know the words at sight; also, what the words mean.

2nd. Call attention to the thoughts expressed.

3rd. Read in easy, conversational tones.

DICTATION.

Write on slates in joined script any 4 consecutive lines in reading limit, observing that each sentence must begin with a capital and end with a period.

SPELLING AND DEFINITIONS.

Oral and written from reading limit; the meaning of words to be taught chiefly from their use in phrases and short sentences.

1st word, I, O, and names of persons and places should be capitals.

ARITHMETIC.

Numeration and notation to 1000; complete addition and subtraction tables; mental arithmetic; Roman numerals to 20.

How to teach.—Teach the pupils that the same numbers always produce a like figure when added: thus, 8 and 7 always give the unit 5, whether the numbers be 18 and 7, or 38 and 7, or 7 and 28; thus, by attending to this fact, while adding single columns, they can readily acquire the habit of *adding without counting*. After the pupils have been thoroughly trained in adding single columns and understand numeration and notation, they can be taught the process of "carrying" in examples of two or more columns. Care should be taken not to embarras children by giving them *long and large* examples in addition before they can readily add short ones. Problems involving addition and subtraction should be given at each lesson to be solved mentally.

GEOGRAPHY.

Place and direction.—First teach position of objects on a table; then the position of objects in the class-room; and lastly, location and direction of streets and other objects near the school.

DRAWING.

Simple figures of any kind.

OBJECT LESSONS.

(1). The circle; arc, radius.

(2). Colour; harmony of colours.

(3). Familiar talks about animals, (comparison, groups, &c.), and plants, (roots, leaves, flowers, &c.)

(4). Occupation, (trades, tools, productions, commodities, &c.)

THIRD GRADE.

(Time allowed—about 5 months.)

READING.

The first 108 pages of the *Second Book*. Train the pupils to habits of distinctness in articulation. (See remarks under 1st and 2nd grades.)

SPELLING AND DICTATION.

To know the meaning of the lessons; to spell orally or on slates any 5 consecutive lines of reading limit. Use of capitals (1st word, I, O, names of persons, places and days of the week); period at the end of sentence.

ARITHMETIC.

Numeration and notation to 100,000; Roman numerals to 100.

Addition and subtraction reviewed

with the view of teaching rapid, correct and neatly executed work. Problems in addition and subtraction.

The multiplication table and multiplication by not more than three figures. Mental arithmetic.

GEOGRAPHY.

In addition to the work prescribed for preceding grades, teach

(1). Location and direction (cardinal points).

(2). What a map is, its cardinal points, what represents land and what water.

(3). The shape of the earth by means of a globe.

(4). The name of the city, town, township and county in which the pupils live, and also of the places in the vicinity.

(5). On map of the world each continent and ocean.

WRITING.

Half an hour a day should now be spent by the class in writing on paper. Payson, Dunton & Scribner's Copies, No. 1. The copy should be written on the board in the presence of the class, and the pupils should be shown the errors likely to be made. See to it at the very outset that the pen is held properly and the position at the desk rightly taken.

DRAWING.

Familiar objects on slates.

OBJECT LESSONS.

(1). Form, shapes compared and described.

(2). Animals compared and classified.

(3). Plants (roots, stems, leaves and flowers.)

(4). Occupations.

[These object lessons, if properly taught, will train pupils to habits of observation, and to the necessity of being able to describe objects correctly. They are also a valuable means of teaching English composition.]

FOURTH GRADE.

(Time allowed—about 5 months.)

READING.

All the Second Book, the first 108 pages being reviewed. Great attention should be given in this grade to distinctness in articulation; it is almost always the *ends* of the words that are not brought out plain and full. Frequent reading from slates.

SPELLING.

From reading limit. Definitions—to know the meaning of the lessons (phrases and peculiar expressions rather than individual words.)

DICTATION.

Exercises in writing words and sentences (six consecutive lines from reading lessons.) Particular attention to be given to the use of capitals already given in former limits.

ARITHMETIC.

(1) Numeration and Notation.

(2) Roman numerals to 1,000.

(3) Complete multiplication.

(4) Problems in addition, subtraction and multiplication.

(5) Division (short and long); division by factors.

(6) Mental Arithmetic should be taught daily; it should precede and accompany written arithmetic; exercises in rapid calculation, without analysis, should be of the most practical character and in no case should lessons be assigned in Mental Arithmetic; the exercise should be spirited.

GEOGRAPHY.

(1). Review previous limits.

(2). Simple, general outline of the geography of the world as a whole.

(3). Definitions—(form, magnitude and motions of the earth; zones, latitude and longitude; continent, peninsula, island, cape, mountain, ocean, sea, gulf, bay, strait, river and lake.)

The pupil should be taught to point these out on the map and to illustrate by

referring to familiar objects that he has seen.

(4). To know the province in which he lives, its capital and the position on the map of Ottawa; to know what a Capital city is.

(5). Draw the county, showing its division into townships, also its cities and towns.

WRITING.

At least half an hour should be given to writing in copy books, (Payson, Dunton & Scribner's). Attention should be given to position, holding pen, &c., as in former grade.

DRAWING.

Straight lines in various positions and combinations; rectilineal figures.

OBJECT LESSONS.

Extension of subjects given in previous limit.

EDITORIAL NOTES.

THE BOY'S OWN PAPER—Wm. Warwick & Sons, Toronto.—This Magazine, although not written for juvenile readers, is not unprofitable reading for adults. It is published weekly in England, and four of these weekly issues are bound together in one cover and form a large monthly magazine. It is a work of substantial value in which boys are led imperceptibly to acquire a taste for the study of science, literature and art. The scientific and literary reputation of the contributors to the Boy's Own Paper is a sufficient guarantee for the accuracy of the science and the tone of the writing throughout. The scientific contributions are remarkably free from those technicalities which are so forbidding to boys and unscientific readers. The whole is enlivened with an abundance of interesting anecdotes, many of which are quite new to us. The numbers for a year bound together would form a real treasure for a boy. The illustrations are exceedingly good and are found on almost every page.

THE GIRL'S OWN PAPER—Wm. Warwick & Sons, Toronto—This paper, as well as the Boy's Own Paper, is published at the low price of $1.50 a year. The writers for these two magazines have succeeded in a marked degree in the rather perilous attempt to combine the popular and the scientific, to be at once engaging and exact, to charm the attention of the ignorant without forfeiting the respect and confidence of the learned. Some idea of the nature of this publication may be gathered from the table of contents:

"How to sing in Public," by Antoinette Stirling; "How to make Bead Flowers," by Marie Karger; "Female Names;" "Occupations for Invalids," by Dora de Blaquiere; "A beautiful and Useful Life;" "My Work Basket;" "The Queen's Domestic Life;" "The Art of Verse Making;" "Other Peoples' Happiness and other Peoples' Things;" "The Drawing Room;" "Some Useful Hints on Surgery;" "Stories in Miniature;" "Easter Eggs and how the girls made them;" "Pies and Tarts;" "Mourning Attire;" "Seasonable Clothing and how to make it;" "Sketching from Nature," by John C. Staples; "Useful Hints—The best pound cake;" "Talks about Gardening;" "Difficulties of a Young House-keeper, and how she overcame them;" "Bits about Animals;" "Sunshine at last"—a complete story by L. C. Silke, and two serial stories, viz.:—"The Queen o' May," by Anne Beale,

and "That Aggravating School Girl," by Grace Stibbing. "The Mountaineer's Bride," a new song with the music by Sir Julius Benedict, is itself worth the price of the magazine. On almost every page there are illustrations which are certainly most effective and add much to the value of the papers. These two papers should find a place in every family.

THE LEISURE HOUR.—The April number of this magazine is an unusually interesting and instructive one. Old subscribers of this magazine are struck with the wonderful progress observable from time to time in its pages. The best evidence of its successful attempt to keep up with the spirit of the age is afforded by the present number. Our limited space will scarcely permit us to do more than glance at its numerous pithy, varied and entertaining articles—prominent among these being a "Biographical Sketch of the great landscape painter Cox;" "The Narrative of a Yachting Cruise in the far North," by W. J. Grant; "An Exposé of Spiritualism;" "Memorable Scenes in the House of Commons." We must not forget to mention the beautiful duet—a gem in its way—"The Sisters," the words written by Tennyson, and the music by Arthur Sullivan. The numerous and beautiful wood-cut engravings interspersed in its pages give this magazine great æsthetic value, and its moderate price brings it within the reach of all. We can cheerfully recommend this magazine to our public school teachers in particular, as an antidote for the cramping intellectual tendencies of their scholastic work.

Canadian Edition $1.50 per year. Wm. Warwick & Son, publishers, Toronto.

THE HUMBOLDT LIBRARY.—J. Fitzgerald & Co., New York.—The publications which go to make up this Library comprise popular expositions of science by Authors of note. The following numbers are already published.

No. 1.—LIGHT SCIENCE FOR LEISURE HOURS—a series of familiar essays on scientific subjects, natural phenomena &c., by Richard Proctor, B. A., F. R. A. S., &c.

No. 2.—THE FORMS OF WATER—in Clouds and Rivers, ice and glaciers, with 19 illustrations drawn under the direction of the Author, by John Tyndall, LL. D., F. R. S.

No. 3.—PHYSICS AND POLITICS.—An application of the principles of natural selection and hereditary to political society, by Walter Bagehot.

No. 4.—EVIDENCE AS TO MAN'S PLACE IN NATURE—by Thos. H. Huxley, F. R. S.

No. 5.—EDUCATION.—Intellectual Moral and Physical, by Herbert Spencer.

No. 6.—TOWN GEOLOGY—by the Rev. Chas. Kingsley, with an appendix by Prof. Huxley, on coral and coral reefs.

No. 7.—THE CONSERVATION OF ENERGY—by Balfour Stewart, LL. D., F. R. S., with an appendix by Prof A. Bain, on the correlation of nervous and mental forces.

No. 8.—THE STUDY OF LANGUAGES—brought back to its true principles by C. Marcel, Knt. Leg. Hon.

No. 9.—THE DATA OF ETHICS—by Herbert Spencer.

No. 10.—THE THEORY OF SOUND IN ITS RELATION TO MUSIC—by Prof. Pietro Blaserna, of the Royal University of Rome.

No. 11 and 12.—THE NATURALISTS ON THE RIVER AMAZON, in two parts. This is a record of adventures, habits of animals, Sketches of Brazilian and Indian Life, and aspects of nature under the Equator during eleven years of travel—Henry Walter Bates, F. L. S.

No. 13.—MIND AND BODY—the

theories of their relation by Prof. Bain.

No. 14.—THE WONDERS OF THE HEAVENS—by Camille Flammarion translated from the French by Mrs. Norman Lockyer.

No. 15.—THE ORIGIN OF SPECIES. The causes of the phenomena of organic nature—a course of six lectures by Prof. Huxley.

No. 16.—LESSONS IN ELECTRICITY, to which is added an elementary lecture on Magnetism, by Prof. Tyndall.

No. 17.—FAMILIAR ESSAYS ON SCIENTIFIC SUBJECTS—by Richard A. Proctor. These comprise Oxygen in the Sun; Sun-spots, Storms and Famine; New Ways of Measuring the Sun's Distance; Drifting Light-waves; The New Star which faded into Star-mist; Star-grouping; Star-drift and Star-mist.

No. 18.—THE ROMANCE OF ASTRONOMY, by R. Kalley Miller, M. A., with an appendix by Richard A. Proctor.

No. 19.—LONGEVITY—The means of prolonging life after middle age, by John Gardner, M. D.

No. 20.—PROGRESS—its law and cause; also, disquisitions on "The Physiology of Laughter;" "Origin and Functions of Music;" "The Social Organism;" "Use and Beauty;" "The Use of Anthropomorphism;"—by Herbert Spencer.

No. 21.—THE PHYSICAL BASIS OF LIFE; also, "The Scientific Aspect of Positiveism;" "A Piece of Chalk;" "Geological Contemporaneity;" "A Liberal Education;"—by Thos. H. Huxley.

These numbers are published twice a month and are sold in Hamilton, both current and back numbers, at the uniform price of 15 cents per copy, by R. Duncan & Co. To subscribers it is $3.00 a year, of 24 numbers. Inasmuch as the price of the works published in the Humboldt Library ranges from $1.25 to $2.00 a volume, (bound in cloth), it is seen that for one annual subscription a person may procure a collection of Scientific Essays, Monographs and Compilations for which he would have to pay, were he to buy them in the usual shape of bound volumes, from 30 to 40 dollars. The attempt to make scientific literature accessible to all classes of readers should receive liberal encouragement from the public. Every teacher should take the Humboldt Library.

In this number will be found the Eleventh Annual Report of the Ontario Mutual Life Assurance Company, Waterloo, Ontario. One of the pleasing features of this Company is the simple way it places its financial position before the public—nothing covered up, but everything laid before its members in the fullest and clearest possible manner. Its economical management and its plans commend themselves to the public, and it is destined at no distant day to be the leading Company in Canada. Being the only purely Mutual Company in Canada it belongs and is exclusively managed for the benefit of its Policy Holders, who own all the assets and control the management. In the April number of this journal will be found Table of Rates and all the necessary information as to its plans and features. We can with great confidence recommend this Company to our readers as sound and reliable in every way. A list of the General Agents of the Company is to be found in this number, and we can only say, in conclusion, if you are thinking about insuring your life, investigate the plans and advantages of the Ontario Mutual Life.

The best books for intermediate work are the following :—

Arithmetic—J. H. Smith's (Eng. edition), Robertson's and Barnard Smith's book of exercises.

Algebra—Colenzo and Todhunter, and for examination questions, J. Hamblin Smith's exercises to end of quadratic equations.

Euclid—Todhunter, books 1 and 2.

English—Smith's and Davies.

Literature—Armstrong's Lady of the Lake, and Chambers' Sir Roger de Coverley.

History—British—Collier's.

" Roman—Collier's.

Geography—Campbell's or Lovell's.

Natural Philosophy—Newth's 29th edition, Statics and Hydrostatics.

Chemistry—Semple's & Finlay's, Inorganic.

Book-keeping—Packard's

Latin Grammar—Harkness.

Latin Authors—White's series.

Latin Prose—Arnold's.

French—De Fiva's Grammar.

" De Fiva's Reader, p.p. 49 to end. Souvestre un Philosophe sous les Toits.

German—Ahn's Grammar; Adler's Reader, parts 1, 2 and 3; Der Gang nach dem Eisenhammer (Schiller); Die Kraniche des Ibycus (Schiller).

In the next number will appear the promotion examination papers for the County of Perth, and also those for North Wellington.

The local examinations of McGill University will begin on Wednesday, June 1st, and continue about a week. These examinations are open to girls and boys, and those passing in Latin and Greek, or Latin, French and German, with Pass Mathematics and English, will be admitted as matriculated students of the University.

The entrance examination to High Schools and Collegiate Institutes will be held on Thursday and Friday, the 7th and 8th of July next.

The intermediate and second-class examinations will be held at the County Towns and High Schools of the Province on Monday, July 11th, at 2 p. m. and be continued during the week.

The examination for 1st class (grade C, non-professional) will be held at the Toronto Normal School, beginning on Monday, July 18th, at 2 p.m.

The professional examination for 1st class certificates will begin after the conclusion of the non-professional examination, and the examination for 1st class certificates, grades A and B, will begin after the conclusion of the professional examination. It is indispensible that candidates, whether from a county or a city, should notify the presiding examiner not later than the 1st of June, of their intention to present themselves for examination.

Dr. Pepper, who was installed the other day as Provost of the University of Pennsylvania, strongly insisted, in his inaugural address, on the necessity of promoting the higher education of women, but at the same time regarded

it as beyond dispute "that the co-education of the sexes is inadmissible." * * * At the last meeting of the Senate of the University of Durham, England, application was made on behalf of a lady for permission to compete for the entrance examination in October next, and if successful, to proceed at the proper time to the degree of B.A. * * * An unusually large meeting of the Senate of Cambridge University was recently held to consider the report of a "Syndicate" appointed to consider certain memorials addressed to the University respecting higher education for women. That report recommended that, subject to certain conditions of residence at Newnham and Girton, female students should be admitted to the Triposexaminations, and certificates issued to them testifying to the results achieved. Nothing seems to have been decided at that meeting, but it is reported that on the subject of female education as a whole "the tendency of the University seems to be in the direction of cautious progress." * * * Harvard has consented to send an examiner to California to conduct examinations there for women as well as men. * * * The Nevada State University at Elko has had during the past year forty-eight pupils, twenty five of whom were girls. * * * In Germany the Victoria Lyceum at Berlin provides for women regular examinations and certificates of excellence in the higher studies. A chair is held by a female Ph. D. In Italy the Universities are open to women, and preparatory schools have been established in some cities. * * * The Massachusetts Society for the University Education of Women has helped six students this year in their University courses. The Society has also done an excellent work in providing pleasant social influences for those students who are strangers in Boston. * * * At a recent meeting of the Senate of Toronto University it was resolved that in the Faculty of Arts the examinations, medals, prizes, certificates of honour, scholarships and degrees should be open to women on the same conditions as to men, except that in the case of women attendance on lectures in an affiliated college should be dispensed with, and that any woman gaining a scholarship should enter into an engagement to expend the money in prosecuting the studies necessary to obtain a degree.

The London *Standard* makes light of the grave discussions which have taken place over the question whether women who have successfully passed the Cambridge University examinations shall be admitted to places in the University class lists. After settling the more important question of their admission to University privileges in their favour, the *Standard* thinks the refusal to grant them what is now sought is more than "straining at a gnat and swallowing a camel—it is an act of positive injustice." The *Times*, commenting on the same point, and alluding to the case of Miss Scott, who took a high position at the mathematical examination last year, says "it seems ungenerous, and not very rational, for a University to let its authorities proclaim a man in the Senate House eighth wrangler and inform Girton College that the real eighth wrangler was a woman."—*Globe.*

"I have a theory about the dead languages, said a new student. "What is it?" asked the teacher. "That they were killed by being studied too hard."

Scene at Harvard. Chinese class. Student (who has just failed in a Chinese sentence, to professor)—"Thou tea-chest!" Professor (furious)—"What! you dare to—" Student (calmly proceeds)—"Thou tea-chest a most difficult language." (Red fire, curtain.)