and cold, cannot be frozen by winter temperature even on mountain tops, and the chemicals are not poisonous. The general chemical action is that the ammonic chloride acts upon the zinc chloride. The hydrogen goes to the manganese dioxide and forms water with its oxygen. This is only general, since other substances may be used and other and more complicated reactions take place.

(10363) A. H. H. writes: A. C.'s land problem in Scientific American of December 22, Query 10271, can be solved by arithmetic in the following manner: $20 : 1.34 :: x : 10$. $20 \times 10 = 200$. $200 \div 1.34 = 149.253+$ rods = one side of field. And $149.253+ \times 149.253+$ = 22276.458+ square rods in field. Now 22276.458+ divided by 160 = 139.222 acres. Explanation: Assume a field 20 rods square. It would of course equal a field of 400 square rods. ¼ being plowed away, leaving 300 square rods, each side of which is 17.32+ rods. From center of this unplowed plat to its edge equals ½ of 17.32+ = 8.66+ rods. Now, 10 rods, half of this assumed field, — 8.66+ rods = 1.34+ rods, which is ¼ of assumed field plowed. Then by proportion: If by plowing 1.34+ rods from a field of 20 rods square, ¼ of the field is plowed; how many acres in a field if an outside strip 10 rods wide is ¼ of it? A. Although no letters are used in the solution above, the genius of it is algebraic as much as if all the quantities were represented by letters. Algebra is a branch of mathematics in which the relations of the quantities are assumed, and upon these assumed quantities, usually letters, the operations are performed till the proper values in numbers are discovered, or till the relations of the letters in the problem are determined in the simplest manner possible in the case. In this problem the number 20 is used as if it were a letter, and operations are performed upon 20 till its relation to the correct number appears. Thus it is seen that the solution is algebraic in essential character, although no letters are employed. Our algebraic solution was simpler than this so-called arithmetical solution.

(10364) G. H. H. asks: 1. Where lay the path of totality of the total eclipse of 1868 or 1869, which was visible, I think, in Iowa, etc.? Duration of eclipse? Width of path? A. We have not the path of the eclipse of 1868 or 1869 in Iowa at hand. You may be able to get it from the U. S. Naval Observatory, Washington, D. C. 2. How must I understand the magnitude of stars given in Standard Dictionary, where Sirius is given as 1.4 and Arcturus 0.3, when Sirius is said to be the brightest fixed star? A. The magnitudes of stars are now given in magnitudes and tenths, based upon the fact that a first-magnitude star is about 100 times as bright as one of the sixth magnitude. Each magnitude is therefore as many times as bright as the one next below it, as starting with 1 and multiplying by the same number will give 100 after five multiplications. This number is the fifth root of 100, or 2.512. Upon this basis an average first-magnitude star is of the brightness of Aldebaran and Altair. The Pole star is of the second magnitude. Stars brighter than the first-magnitude stars must be expressed by a number indicating that fact. Sirius is —1.4 magnitude. See Young's "Elements of Astronomy," which we send for $2.

(10365) C. B. asks: 1. Can stains on the finger nails caused by pyrogallic acid in a photographic developer be removed, and how? A. Cyanide of potassium will remove most stains produced by photographic chemicals. It should be used with extreme care. It is better to have the stain than to be poisoned. 2. Can you give me a developer for films which will not stain fingers and does not contain bromide of potassium? A. There is no developer which will not stain, and none in use at present which do not require bromide of potassium as a restrainer. 3. Can a 110-volt alternating current be transformed to a 10-volt direct current without using a rotary transformer, and how? A. It is necessary to use a rotary transformer to convert an alternating current into a direct current. 4. How much water should be added to c. p. sulphuric acid to make the so-called H_2SO_4 dilute? A. Dilute sulphuric acid is a somewhat indefinite term. When a concentrated acid shows 1.84 on the hydrometer, it will show 1.07 hydrometer if made a 10 per cent solution, and 1.14 hydrometer if made a 20 per cent solution. Both these percentages are used, and are called dilute acid.

(10366) S. A. W. asks: An article on standard time on page 124 of Todd's "New Astronomy" contains the following: "The whole country is divided into four sections or meridian belts, approximately 15 deg. of longitude in width, so that each varies from those adjacent to it by exactly an hour. The time in the whole 'Eastern' section is that of the 75th meridian from Greenwich, making it five hours slower than Greenwich time. This standard meridian coincides almost exactly with the local time of Utica and Philadelphia and extends to Buffalo." One would infer from the above that Buffalo or the 79th meridian was the western boundary of the eastern standard or 75th time belt. If each section or belt is 15 deg. wide and the 75th meridian is at the center of the 'Eastern' section, I cannot see why the western boundary of this section should not be 7½ deg. west of the 75th meridian or ½ degree west of the 82d meridian, which would be at a line drawn from Port Huron, Mich., to Tampa, Fla., which is as far west of Buffalo as Buffalo is west of the 75th meridian. Will you kindly explain this through the columns of your paper? A. The statement quoted from Todd's "New Astronomy" is correct. The inference made from the statement is not correct. The places at which the change shall be made from the time of one section to that of the next westerly section depends largely upon the convenience of the railroads and not upon the longitude. The system of standard time in America was adopted for the benefit of the traveling public and the railroads, and not to satisfy any sentiments of astronomers as to scientific fitness of things. It was a practical and not a scientific arrangement. So the roads centering in Buffalo make the change from Eastern to Central Meridian time at Buffalo, since the roads of several companies end at Buffalo. The change is made at Pittsburg for the Pennsylvania system. A comparison of the maps of the roads giving the points at which the changes of time are made will show some strange departures from the longitudinal belt of 15 degrees in width. At one place in the Southwest Pacific time meets Central time so that the Mountain division is quite eliminated at that point.

(10367) C. M. T. asks: 1. What is air, and how it is generated? A. Air is a mixture of nitrogen 4 parts, oxygen 1 part, with traces of some other gases. To these are added minute quantities of carbon dioxide and other products of animal life as impurities. Water vapor is also always present in the atmosphere. 2. Did it exist from the very birth of the earth or some time after? A. The atmosphere has been on the earth from the first, although its composition has changed as the earth has cooled. Once all the water of the earth was in the atmosphere, and remained there till the temperature fell below the boiling point of water. The water then came down in great rains. 3. Is the air destructible? Can it be destroyed or burnt out by fire? If it is not destroyed, you mean to say that the air which we breathe to-day is the same that was on the earth millions of years ago? A. The nitrogen of the atmosphere cannot be destroyed by any ordinary means. It is a most inert substance chemically. The oxygen is readily passed into combination with carbon by combustion, and with many other substances by chemical combinations as oxides. The most familiar example of this perhaps is iron rusting in the air. Plants and animals all live from the oxygen of the air. The animal world takes oxygen from the air to breathe and gives it out as carbon dioxide, which the plant takes up and separates for its food, giving off the oxygen again into the air. Thus oxygen is continually passing out of the air and back again into the air. In a sense the air we breathe to-day is the same as animals breathed at the first. But since that time it has been subject to numberless chemical changes, and has been perhaps in liquid and solid forms many times.

(10368) V. P. H. and others: We are receiving many queries regarding cannon, guns, balls, etc., shot from moving trains in every variety of ways which ingenuity can devise and describe. A recent correspondent states seven different propositions, all different conceptions of one and the same thing. We have not time or space to take up this matter. We have heard it discussed for a long lifetime, and apparently it will not down. The answer to all these conundrums is in the Second of Newton's Laws of Motion: "A given force produces the same effect whether it acts upon a body at rest or in motion; whether it acts alone or together with other forces." This has been accepted universally for centuries, and is an established fact. To apply this law to the case in question it is only necessary to say that the discharge of the powder produces the same effect upon the ball under all circumstances. It is also necessary to say that the motion of the train produces the same effect upon the ball as if the powder had not been exploded. The ball is at any time just where the two motions will together carry it. Calculate this and you have the answer. We do not desire communications upon this subject. Let our esteemed correspondents find something new to write about.

(10369) J. E. B. writes: In your issue of December 22, 1906, question 10271, a farmer having plowed a strip ten rods wide around a square field finds he has finished one-fourth of the field. How many acres? You say that this is not an arithmetical problem, but requires algebra for its solution. Fifty years ago a country school teacher in Iowa used to tell us that *all* problems could be solved by arithmetic. Perhaps he was right. Solution No. 2. Divide a square by diagonals into four triangles. Divide one triangle into two right-angle triangles by a perpendicular from the center of the square. Assume that the base of one of these triangles is any length, four rods long. Then, as base and perpendicular are equal, the area is one-half of the square of the base, viz., eight square rods. One-fourth of this triangle having been plowed, the base and perpendicular of the remaining similar triangle would be the square root of twelve, viz., 3.464. This subtracted from 4 leaves 0.536, the width of the plowed strip. Then, by proportion, $0.536 : 4 :: 10 : 74.6$. But the base of the triangle is one-half of the side of the square, viz., 149.2 rods, your answer by algebra. A. Your solution of the problem regarding the plowed field is quite correct. You assume a figure with a "base of any length, four rods long." Then from this you calculate the parts on the conditions of the original problem, and at last arrive at the proportion between your assumed figure and the figure given in the problem, from which the length of the side of the square field is found. Permit us to say that this process is not arithmetical, but algebraic. It is easier to use a letter to represent the side of the square and proceed with the calculation till the numerical value of the assumed letter is found than to do it as you did. To use only numbers does not make a process arithmetical. In an arithmetical process the numbers given in the problem are taken and the calculation is based upon those numbers and continued till the answer is found. In an algebraic solution the answer is assumed, usually as a letter, or else some quantity so related to the answer that the value of the answer can be computed from the assumed quantity, and the calculations are based upon the assumed number or quantity. This is what you did in solving the problem. Arithmetic has its place and uses. So has algebra. Many of the older arithmetics contained problems which were solved by assuming a quantity and working with it. This rendered the solution algebraic. It was by such processes that your old teacher justified his saying about solving all problems by arithmetic.

(10370) L. W. asks: In the year 1833, in the month of November (do not recall the day of the month; I would have been eight on 2d of March) I witnessed just at daybreak in the morning that great and notable event of the falling of the stars, or meteoric shower. It was a magnificent sight, and as vivid to my mental sight as at the time. It resembled and I thought it was large snowflakes, but disappeared as fast as they fell. Why I was out of my trundlebed at that time and looking out of the window, I do not recall. My parents or no one saw it but myself, as I was frightened and went back to bed. This was in Centreville, Allegany County, New York. From that time on I have never seen the like, neither any one who has. But I have talked with those who saw them at that time. Now they are said to be periodic, about the 14th of November. Now what I wish to know is, where are they perceived—in what localities? and why not universal? Are shooting stars classed as meteors? What is the cause of meteors? A. The meteoric shower which you so vividly remember occurs once in about 33¼ years, on the night of November 14. If it occurs when the sun is above the horizon of a place it is not seen at all. It occurs here in New York in the early morning hours. There were showers in 1833, 1866, 1898, and in 1901. None of these later showers were as brilliant as that of 1833. The earth crosses the orbit of the meteors each November 14, but the meteors are at the same place at the same time as the earth only once in 33¼ years.

(10371) W. B. C. says: Why is it that when water freezes bubbles are formed in the ice? I once left a tumbler of water outside on a cold night, and on finding it the next morning, I found the water frozen half way down the glass in a series of domes. Between the bottom of the ice and the unfrozen water was a bubble of air as big as a pea. I have always been curious to know how that air got there, as so far as I know the glass was absolutely undisturbed while the water was freezing. The solution of this problem would interest me very much. A. Bubbles of air appear in ice because the air was dissolved in the water before it was frozen. Upon freezing, the air separates from the water. Water in a natural condition always contains air, else it would be tasteless and fish could not live in it. If a glass of cold water is allowed to stand and grow warm, the air separates from the water in a similar manner and appears as bubbles on the sides of the glass.

(10372) S. M. D. asks: Is there any limit to the distance that a certain amount of electricity will travel over wire, that is, will a weak battery send electricity as far as a strong battery? A. There is a limit of distance to which a small amount of electric current can affect an instrument so that it can be perceived. This is at a less distance than a strong current can affect the same instrument. In this sense a weak current cannot travel as far as a strong one over a wire. A weak battery cannot produce the same effect through a mile of wire as a strong battery can; but if we had more delicate instruments we might still detect the weak current much farther than we can at present. It is not so much the defect of the current as of the instruments for observing it.

(10373) G. H. says: I would like to get or make a cold solution, say a few degrees above the freezing point, in small quantities. Could you advise me where I can obtain such a thing or what chemicals are needed to produce it? A. You may obtain a low temperature by the addition of hydrochloric acid to crystals of sodium sulphate. By using strong acid a fall of temperature to ten or more degrees below freezing can be had. Different proportions of acid and water will cause different temperatures. We have no tables giving the parts of each to be used, and you can determine by experiment the parts of each to be taken for the temperature you wish to obtain. Water alone poured upon the crystals will produce quite a fall of temperature.

NEW BOOKS, ETC.

Inorganic Qualitative Chemical Analysis. By William Stowell Leavenworth, M.Sc. Easton, Pa.: The Chemical Publishing Company, 1906. Pp. 153. Price, 1.50.

This book provides a manual holding an intermediate position between an elaborate treatise and a skeleton outline of the subject. The work is concise but clear throughout; it is hardly available for the elementary student, as a certain familiarity with general chemistry will be found necessary. The appendix contains a full and useful list of reagents, a list of suitable apparatus, and other convenient data, which will be found useful for supplementing the information contained in the body of the volume.

Business Organization. By Samuel E. Sparling, Ph.D. New York: The Macmillan Company, 1906. 12mo.; pp. 374. Price, $1.25 net.

This volume is an outgrowth of a course of lectures on Business Organization and Management, delivered at the University of Wisconsin in connection with the courses in Commerce. The growth of the literature of commercial activity indicates the increasing interest manifested in the systematic study of business institutions and corporations. But as there have been few books fully covering modern business from the viewpoint of organization, Dr. Sparling's contribution will fill a decided want in this connection. The book is well written and covers the subject thoroughly, notwithstanding that the plan of treatment was necessarily somewhat arbitrary.

Taschenbuch der Kriegsflotten. VIII. Jahrgang, 1907. By B. Weyer, Kapitänleutnant a.D. Munich: J. F. Lehmann's Verlag, 1907. 12mo.; pp. 403.

Capt. Weyer's Annual may be considered a very compact and accurate review of the state of naval affairs in all countries down to the first of December, 1906. Following the plan which has been adopted in previous issues, he has endeavored to present a photograph of every type of ship, together with longitudinal and plan views, in which the armor and gun positions are clearly indicated. Constant use of the previous volumes that have appeared justify us in assuring for this book a well-deserved success.

A Technological and Scientific Dictionary. Edited by G. F. Goodchild and C. F. Tweney. Philadelphia: J. B. Lippincott Company, 1906. Large 8vo.; pp. 875. Price, $6.

The title of this useful book explains fully its object. The definitions are concise, brief, but nevertheless of sufficient length to be of value in almost every case. Chemical formulas are freely given. Illustrations are provided, supplementing the explanations of certain of the terms defined. Various important subjects are discussed at great length.

Internal Energy. By John V. V. Booraem, M.E. New York: McGraw Publishing Company, 1906. 12mo.; pp. 144.

The author has undertaken a task in this book which at first glance would appear positively staggering. This is to suggest a simple working hypothesis whereby the amount of all chemical energy stored within a body may be estimated. The work is based upon familiar lines of experimental data, the idea originating from a mathematical study of the periodic curves of the atomic volumes and melting points. The hypothesis is based upon a mathematical method, and provides for expressing the relations of heat to mass through great ranges of temperature.

Le Canal de Suez. By Voisin Bey. In Seven Volumes. Paris: H. Dunod et E. Pinat, Editeurs, 1906.

Second Report of the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. By Andrew Balfour, M.D., B.Sc., F.R.C.P. Edin., D.P.H. Camb. Khartoum: Department of Education, Sudan Government, 1906. 4to.; pp. 255.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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