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Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8703) J. M. L. asks: 1. Will you please give me the two laws of thermodynamics? 1. The first law of thermodynamics is: "Whenever work is performed by the agency of heat, an amount of heat disappears equivalent to the work performed; and whenever mechanical work is spent in generating heat, the heat generated is equivalent to the work thus spent." (De Schanel.) The formula is $W = JH$. W is the work in foot-pounds, if English measures are used; H the degrees which one pound of water would be raised in temperature by the heat; and J, Joule's equivalent, 772 foot-pounds, as determined by Joule, or 773 foot-pounds as redetermined lately by Rowland. The second law is variously stated by different authors. Perhaps the simplest form of the law is: "It is impossible for a self-acting machine, unaided by any external agency, to convert heat from one body to another of a higher temperature." (Clausius.) Another form is: "The efficiency of a completely reversible engine is independent of the nature of the working substance, and depends only on the temperature at which the engine takes in and gives out heat; and the efficiency of such an engine is the limit of possible efficiency for any engine." (De Schanel.) 2. If the specific heat of gold is 0.03244, what weight of it at 470 degs. C. will raise 1 kilogramme of water from 12.3 degs. to 15.7 degs, C.? A. The water is to be raised 3.4 deg. C. 1,000 grammes require 1,000 calories per degree of rise of temperature, and for 3.4 deg. rise require 3,400 calories. The gold is to lose 470 deg. —15.7 deg., or 454.3 deg. One gramme of gold gives out 0.03244 calorie for each degree of loss of temperature, and for 454.3 deg. will give off $0.03244 \times 454.3 = 14.737$ calories. As many grammes of gold will be required as 3,400 contains 14.737, which is 230.7 grammes of gold.

(8704) T. A. says: The following method is given in "Cyclopedia of Receipts" for deodorizing petroleum: Mix chloride of lime with petroleum in the proportion of three ounces to each gallon of the liquid to be purified. It is then introduced into a cask. Some muriatic acid is added and the mixture is well agitated, so as to bring the whole of the liquid into intimate contact with the chlorine gas. Finally the petroleum is passed into another vessel containing slaked lime, which absorbs the free chlorine and leaves the oil sufficiently deodorized and purified. Can you suggest the quantities required of muriatic acid and slaked lime? Also if the cask should have one end open or agitated with the bung in? Is there any danger attending this process? A. The quantities of muriatic acid and slaked lime to be used in deodorizing petroleum are not important. If an excess of acid were used, it would disappear when the liquid is passed through the lime. Probably 3 fluid ounces per gallon will be sufficient to furnish enough chlorine for the process. Similarly, the bung may be in or out of the cask. There will not be excessive pressure in the operation; yet if the cask is open, the escape of chlorine will not be very annoying in the open air. The only danger we can see in the work is the inhaling of chlorine gas. This would be disagreeable, and if a large quantity were taken into the lungs, it would be dangerous.

(8705) P. E. J. asks: Does liquid when boiling give off air in the shape of bubbles which pass to the surface? If this is the case, why does mercury do so if this metal is always used to extract air from tubes, etc.? Or is it only the vapor of Hg that bubbles? A. When a liquid is boiling it is giving off its own vapor into the air, if it has been heated for a time sufficient to drive off the contained air. Even mercury contains air under ordinary conditions. Only after it has been heated is the air driven out. In filling a barometer tube the mercury is boiled to get rid of its contained air, which would injure the vacuum.

(8706) W. C. P. asks: Some few years ago I saw on sale a self-lighting gas-tip which I believe was referred to as a platinum sponge. Have you any publications which treat on this subject, its principle and method of construction? A. Self-lighting gas jets are made by placing a lump of spongy platinum so that the gas will strike it. The absorbing power of the sponge is very great and the absorbed gas becomes so hot that the sponge is heated to a red heat and ignites the gas. Platinum sponge can be obtained from dealers in chemicals. It is simply the Doebereiner's lamp or philosopher's lamp, as it was called, which was used for lighting lamps, etc., before the invention of the friction match. The sponge for some reason soon loses its efficiency.

(8707) J. H. asks: 1. Can you tell me if it is possible to get mica in solution, if so, how? A. Mica is not soluble. It may be ground to a powder and formed into a paste with shellac or some varnish. 2. Is there any form of silica soluble in water, or any other simple solvent? A. There are soluble silicas. Soluble glass, sodium silicate, or potassium silicate, is of this sort. These substances are often called water glass. 3. I once saw some small clay vessels made on the potter's wheel; after a vessel was finished, the exhibitor poured some transparent liquid upon it from a bottle, which glazed and hardened it at once. Can you give a formula for such a liquid? A. You will find a large number of formulas for glazes in the "Scientific American Cyclopædia of Recipes," price $5 by mail. We do not know to what glaze you refer in your inquiry.

(8708) W. J. B. asks: 1. What gas has the most ascending power to the square inch? How much ascending power has it to the square inch? A. Hydrogen is the lightest gas known, and has therefore the greatest lifting power in a balloon; 1,000 cubic feet will lift seventy pounds. 2. Can this gas stand being slightly compressed? A. Hydrogen can be compressed to any extent. 3. Can you give a receipt for partially or wholly petrifying wood and leather? A. If wood be soaked in copperas or sulphate of copper and dried, and the process be repeated till the wood is thoroughly saturated with the chemical, its structure when burned will remain in the peroxide of iron left. Petrified wood in nature is another thing. This is probably formed by the slow action of silica. As a particle of wood decays a particle of silica takes its place, and finally all the vegetable matter is replaced by mineral matter. This process has not been imitated artificially.

(8709) J. D. C. writes: Please send me a receipt for keeping cider sweet. Please tell me also if it will stay sweet in vinegar barrels. A. To preserve cider without fermentation, it is necessary that it be made from good fruit, rejecting all decayed apples, and keeping all apparatus in a clean and sweet condition during the manufacture of the cider. The barrels or casks into which it is put must also be clean and sweet. Vinegar barrels cannot be used, since they already contain the germs of fermentation. Scientific American Supplement No. 313, price ten cents, contains instructions for making and preserving cider. In addition to the preservatives given in that article, you may use salicylic acid, one half ounce to a cask of fifty gallons. It is important to exclude the air as much as possible from the cask all the time, and to avoid stirring up the preservative from the bottom of the cask where it settles.

(8710) M. O. C. asks: Can you inform us how to copper common iron castings without a battery so they will not rust, or how to whiten them by dipping? A. To copper iron castings, the articles must be made perfectly clean, and then dipped in a solution of 1½ pounds copper sulphate in water to which 1 ounce sulphuric acid has been added. They are then washed and dried.

(8711) D. E. asks: Please let me know if there is a cheap and simple way to change 110-volt 1 1-5 ampere alternating current to a steady current? A. A rotary transformer is the only practical way to change an alternating to a direct current. This is a motor run by the alternating current and having a winding leading to a commutator, by which the direct current is taken off at the other end of the shaft of the machine.

(8712) H. B. says: 1. I have a closed-circuit battery in which there are two plates of carbon and one plate of zinc. What would be the solution I could use in this battery to best advantage? A. Use a bichromate solution or a chromic acid solution. 2. In winding the field magnet and the armature core of an electric motor, is it absolutely necessary that the same gage wire be used? That is, must the wire on the field be the same size as the wire on the core? A. No. The gage of wire is determined by calculation and one may be either larger, the same size or smaller than the other.

(8713) W. H. asks: Please give me the best formula for a dry primary battery. A. One of the best dry cells is said to be filled with the following mixture: Oxide of zinc, 1 part by weight; sal-ammoniac, 1 part; plaster of Paris, 3 parts; chloride of zinc, 1 part; water, 2 parts.

(8714) J. H. asks: 1. In a transformer supplied with a two or three-phase current how does the winding differ in said transformer from a single-phase? Is there only one primary circuit? A. A transformer may have any one of several forms of winding for its secondary, on two and three phase currents. In America it is common to use a separate transformer in each phase of a three-phase circuit. Many diagrams of connections and wiring may be found in Sheldon's "Alter-

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nating Current Machines," price $2.50 by mail. 2. What is the general belief as to the velocity of the electric current? Is it possible that it travels 288,000 miles in one second? Would it not consume the conductor by heat? A. Probably. No one now believes that electricity travels 288,000 miles a second. The velocity of electric waves through space is believed to be the same as that of light, 185,000 miles per second. The electric current travels along a wire much slower than that. Prof. Barker in his "Text-Book of Physics" says: "It is evident that the term velocity of electrical transmission has no definite meaning."

(8715) A. S. asks: Can a waterwheel drive anything, or give power, if its speed is increased by any motor over the speed which the water imparts to it? In other words, if it is driven faster than it would run being released from all load. A. A waterwheel given an increased speed by means of a motor will give less power from the action of the water in proportion to the increased speed; but the power of the motor must be added for the total work. If the power of a motor is added to the wheel at its normal speed, the whole value of the motor will be added to the full power of the wheel alone.

(8716) G. B. K. asks: 1. Kindly inform me through your columns the dimensions of the envelope of a balloon, cigar-shaped, which would raise one pound seventy-five feet in the air, inflated with illuminating gas? A. About twenty-five cubic feet of illuminating gas are required to lift one pound. The weight of the balloon is included in the weight lifted, of course. 2. What kind of paper can be used for making small balloons and where can it be had? A. Any sort of paper may be used for making a balloon. The paper would need to be varnished to enable it to retain the gas, which would otherwise pass easily through the pores of the paper and escape.

(8717) C. M. D. asks: 1. What is the normal humidity for this locality? A. The mean annual relative humidity of Philadelphia is about 70 per cent. This is what we understand the phrase "*normal humidity*" which you use means. We do not know any normal or proper humidity. At least the proper humidity must be the average humidity. 2. What per cent of saturation should the atmosphere contain to be normal for respiration? A. The relative humidity for respiration may be anything from 30 to 75 and perhaps more according to the temperature. There is a wide range possible in which respiration is healthy and no harm can come to a person from using the air. 3. What volume of water should the atmosphere of a room 16 feet x 10 feet x 10 feet contain with the humidity normal and the temperature at 75 deg. F? A. At 75 degrees the relative humidity is about 75 per cent. This is the mean for July in the eastern United States, and may be taken for the mean at that temperature in a room. Under these conditions the air contains 6 grains of water per cubic foot. 4. Would the air in the living rooms of a house contain more moisture (volume) at the point of saturation than the normal atmosphere outside? A. The air in a room, if at a higher temperature than the outside air and saturated, will contain more weight of water than the air outside. This, however, cannot be realized except by artificial means, since the air which enters the room and is heated will by heating have its degree of saturation reduced. Its relative humidity will become lower, while the number of grains per cubic foot will be the same as before it entered the room.

(8718) X. asks: Does Mr. Edison send up an electric star so people from miles away can see it? A. There can be no such thing as an electric star. Any one who knows the amount of the curvature of the earth in an approximately level country will know that an electric light cannot possibly be hoisted high enough on a pole to be visible from afar. What, then, is seen to give rise to the idea? It is doubtless the evening star near its setting, or some bright star which happens to be in a position to be seen in the direction of Mr. Edison's home from the point of view of the observer. We think that is all there is in the question. That Mr. Edison sends up an electric light for this purpose has been denied over and over again.

(8719) S. V. T. asks: In what leap year did February begin with Sunday, the first of the said month, and end with Sunday, the 29th of said month? What year will the same dates happen again? A. A common year of 365 days has 52 weeks and 1 day; hence it begins and ends on the same day of the week, and each year begins one day of the week later than the year before it. A leap year has 52 weeks and 2 days: hence it ends one day in the week later than it began, and the year following a leap year begins two days in the week later than the preceding leap year. Also, in order that February of a year may begin on a Sunday, it is necessary that January should begin on Thursday. Bearing these facts in mind, it is very easy to count forward and backward and find a leap year beginning on Thursday. The last leap year to begin on Thursday was 1880; the next will be 1920. There are rules better than the above for calculating dates, past and future, but for finding a day in a year near at hand this seems to be the simplest method.