

4. What is the distinction between the primary, and the secondary or storage cell? Describe fully some primary cell with which you are familiar and point out any advantages or disadvantages it may possess.

5. What is an induced current? State what you can about the amount and direction of the induced current.

6. Describe different kinds of spectra and tell something of their origin.

NOTES.

RATIO AND DIVISION.

Professor Miller's article in the April number of *SCHOOL SCIENCE AND MATHEMATICS* contains (p. 299) a reference to a distinction often spoken of between ratio and division. May I ask what is the difference between a ratio and the quotient of a division? In other words, what difference is there between a/b meaning a divided by b , and a/b meaning the ratio of a to b ? Some books do not define ratio at all, and those which do say it is "the relative magnitude of two numbers, expressed by the quotient of the first by the second." To make any distinction between this "relative magnitude" and the quotient which expresses it is like distinguishing between the length of a ten-foot pole and the distance ten feet, which expresses that length. There is no possible way of either expressing or conceiving of a ratio except as the abstract number by which one must be multiplied in order to produce the other—in other words, the quotient. Ray's *Higher Arithmetic* contains the express statement, "a ratio is a quotient," and every text-book, so far as I can recall, that I have ever seen, treating the theory of proportion, bases its demonstrations on the assumption that a ratio is a quotient. I am anxious to know what "confusion" arises from this "double meaning," if it indeed is a double meaning. The only reasonable definition of division is "the process of finding one of two factors, when the other factor and the product are given." Thus, if the product is \$10 and one factor is \$5, the other is the abstract number 2, which is the quotient, and is also the ratio between \$10 and \$5.

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AN OAK WITH A HISTORY.

NICHOLAS KNIGHT.

A large white oak, forty-three inches in diameter, in the timber land of George Barge, two miles southeast of Mount Vernon, Iowa, was recently cut down. Counting the rings, it was 273 years old, and solid throughout. In 1760, when the tree was 125 years old, a notch about one foot long and three inches deep was cut into it. The notch was completely filled with a cambium layer, and was hidden from view until the log was split. The tree had increased by a radius of nine inches since the notch was cut. For what purpose the notch was made, or by whom, can only be conjectured. It is not known that white men had penetrated so far into the interior of the country as early as 1760, and how an Indian could come into possession of a hatchet

in that day, unless he used an instrument quite unlike anything we know, is something of a mystery. Early in its history, the Hudson Bay Company had distributed such instruments among the aborigines, which may account for the notch. Whether the tree was cut into for a mark, or with the idea of felling it, the record of course has nothing to say.

DECAY IN WOOD PREVENTED.

It is estimated that a fence post, which under ordinary circumstances will last for perhaps two years, will, if given preservative treatment costing about 10 cents, last eighteen years. The service of other timbers, such as railroad ties, telephone poles, and mine props, can be doubled and often trebled by inexpensive preservative treatment. To-day, when the cost of wood is a big item to every farmer, every stockman, every railroad manager—to everyone, in fact, who must use timber where it is likely to decay—this is a fact which should be carefully considered.

It is easy to see that if the length of time timbers can be used is doubled, only half as much timber will be required as before, and only one-half as much money will need to be spent in the purchase of timber. Moreover, many woods which were for a long time considered almost worthless can be treated and made to last as long as the scarcer and more expensive kinds.

Of the actual saving in dollars and cents through preserving treatment, a fence post such as was mentioned at the beginning might serve as one example. The post is of loblolly pine, and costs, untreated, about 8 cents, or, including the cost of setting, 14 cents. It lasts about two years. Compounding interest at 5 per cent, the annual charge of such a post is 7.53 cents; that is, it costs 7.53 cents a year to keep the post in service. Preservative treatment costing 10 cents will increase its length of life to about eighteen years. In this case the total cost of the post, set, is 24 cents, which, compounded at 5 per cent, gives an annual charge of 2.04 cents. Thus the saving due to treatment is 5.49 cents a year. Assuming that there are 200 posts per mile, there is a saving each year for every mile of fence of a sum equivalent to the interest on \$219.60.

In the same way preservative treatment will increase the length of life of a loblolly pine railroad tie from five years to twelve years and will reduce the annual charge from 11.52 cents to 9.48 cents, which amounts to a saving of \$58.75 per mile.

It is estimated that 150,000 acres are required each year to grow timber for the anthracite coal mines alone. The average life of an untreated mine prop is not more than three years. By proper preservative treatment it can be prolonged by many times this figure. Telephone and telegraph poles, which in ten or twelve years, or even less, decay so badly at the ground line that they have to be removed, can, by a simple treatment of their butts, be made to last twenty or twenty-five years. Sap shingles, which are almost valueless in their natural state, can easily be treated and made to outlast even painted shingles of the most decay-resistant woods. Thousands of dollars are lost every year by the so-called "bluing" of freshly sawed sapwood lumber. This