meaning of the words which stand for them may be fully comprehended.

The pupil, then, we will suppose is thoroughly master—through the methods already described—of the number 10. How do we then proceed? The balls are placed on the first wire of the numeral Frame (or marks on slate, &c.), then *one* ball is placed under the 10, on the second wire, making *eleven*; *two* balls are placed on the third wire (or in third row of marks, &c.) making, with the 10 on the first wire, *twelve*; *three* balls on the fourth wire, making *thirteen*; and so on, till we have 10 balls on the eleventh wire, making, with the 10 on the first wire, 20. This arrangement of the balls is adopted by many experienced teachers on the ground that it brings the several numbers and their relative values, as compared with 10, and with each other, more distinctly before the eye. Some, however, prefer to use but twenty balls, and these on two wires, which, on the whole, may be the more effective plan. Ten balls are placed on the first wire, representing the number with which the pupil is already familiar; then balls are placed *one* by one on the second wire, representing all the numbers from 11 to 20 inclusive. The pupil is first taught to name the numbers in consecutive order, and is then drilled in varying order till he is able to name any number of objects (within the given limits) which may be presented, and mark off the number of objects corresponding to any name. He is to be carefully taught the values of the several numbers as compared with 10, *e.g.*, 11 is *one* ten and 1, 12 is *one* ten and 2, 13 is *one* ten and 3, &c. He should also be taught (always with reference to *objects*) the relative values of the several numbers—as *e.g.*, 13 = 10 + 3, = 12 + 1; 15 = 14 + 1 = 12 + 3 = 11 + 4, &c. He is then to be thoroughly practised in addition and subtraction—the results, of course, not involving any number higher than 20: 10 and 1 are? 10 and 2 are? 2 + 10? 10 + 3 = ? 3 + 10 = ? &c., 11 + 1 = ? 11 + 2 = ? 2 + 11 = ? &c.; 12 + 2 = ? 2 + 12 = ?; 13 + 1 = ? 13 + 2 = ? 2 + 13 = ? &c., &c. Addition and subtraction should be taught together: 10 and 3 are 13, 13 − 3 = ? 13 − 10 = ? Let there be abundant drilling in the systematic formation of the tables: 1 and 2, 1 and 3, 1 and 4, &c.; 2 and 1, 2 and 3, 2 and 4, &c.; 3 and 1, 3 and 2, 3 and 3, 3 and 4, &c. Let the pupils also add by twos, threes, &c., merely giving the *results*, *e.g.*, 2, 4, 6, 8, 10 . . . 20; 1, 3, 5, 7 . . . 19; 2, 6, 10, 14, 18; 3, 6, 9, . . . 18, &c., &c. And let them *subtract* by *twos*, *threes*, &c., giving *results* merely: 20, 18, 16, &c.; 20, 17, 14, &c.; 12, 10, 8, &c. Then, as before described, let numerous problems be given: Harry has 6 marbles and buys 7 more, how many has he now? He has 13 marbles; he gives 7 to Willie, how many has he left? A boy spent 12 cents in candies and 8 cents in apples, how much did he spend? A boy had 15 cents, he gave three cents for a pencil, how much had he left? John has a twenty cent. piece, he buys a pencil at 2 cents and a slate at 12 cents, how much change is he to receive? To secure *quickness* and accuracy, there should be much individual and class drill in combination questions: 4 and 5 and 7 *minus* 3 *minus* 2 are how many? Take the number 6, add 7, subtract 3, add 5, add 4, subtract 11, what is the result? With thorough drilling of this kind a wonderful degree of quickness as well as accuracy may be attained—the pupils acquiring the power to *think* as rapidly as the teacher speaks, and giving the results almost simultaneously with the teacher's last word. This is, therefore, a most valuable exercise; those are wrong who say "no matter what *time* you take in the calculation, be *accurate*." Accuracy is indeed essential; rapidity is also essential; "slow and sure" is good, but QUICK and sure is infinitely better; to give the impression that it matters not what *time* is taken provided the result is correct, is to offer a premium on mental dawdling. Once more, pupils must be trained to accuracy, but equally they must be trained to rapidity in mental calculation, if the value of the science as knowledge, as well as its value in discipline, is to be fully secured.

(To be continued.)

Science Notes.

1. Why does crouching down at the highest point in a swing and standing up at the lowest point, increase the velocity?

2. A balloon is moving upward with a certain velocity;—a weight is suspended from the balloon with a string;—if the string be cut what will be the motion of the weight?

3. A ball is dropped at a height of 64 feet from the ground. At the same instant another ball is thrown upward vertically from the ground with sufficient velocity to carry it to the height of 64 feet. Where will the two balls pass each other?

4. Should a long rope be used in towing a canal boat by a steam-tug, the same as by a horse?

5. What difference would there be in the guinea-and-feather experiment, if air were forced into the long tube instead of being removed?

6. A piece of gold is in equilibrium with a piece of cork on the scales of a delicate balance. Afterward the cork is removed and tin is put in the scale pan to keep the gold in equilibrium. If the gold be now removed and the cork put in its place, will there still be an equilibrium?

FACTS ABOUT VENTILATION.—The average pupil vitiates .08 per cent., or 10.85 cu. ft. of air in one minute. In ten minutes he will require 108.5 cu. ft., and in twenty minutes, 209 cu. ft. The entire air in every school-room should be changed six times an hour, or every ten minutes. It is not fit for human beings to breathe unless it is changed at least three times every hour, or every twenty minutes. The best accidental ventilation changes the air four times an hour. There is a difference of opinion as to the per cent. of carbonic acid that may be habitually breathed without apparent injury. No authority allows more than .08 per cent., but many regard this quantity as injurious. Air that has been once in a healthy lung contains from three to five per cent. of carbonic acid, and in such air a candle will not burn. One per cent. in the air is beyond the limit of ordinary endurance, and one-tenth of this amount soon makes itself felt by persons whose sensibilities have not been blunted.

AN ANTIDOTE FOR STRYCHNINE.—According to some recent experiments of Dr. Lelli, detailed in the *Lancet*, strong coffee may be successfully used to counteract poisoning by strychnine. The experiments were made upon rabbits, and were tried in consequence of a reported instance of failure in an attempt to poison a family where strychnine had been introduced into the coffee-pot.

CURIOUS ITEMS.—If a tallow candle be placed in a gun and shot at a door, it will go through without sustaining injury; and if a musket ball be fired into the water, it will not only rebound, but be flattened; if fired though a pane of glass, it will make a hole the size of the ball without cracking the glass; if suspended by a thread it will make no difference, and the thread will not even vibrate. Cork, if sunk 200 feet in the ocean, will not rise on account of the pressure of the water. In the Arctic regions, when the thermometer is below zero, persons can converse more than a mile distant; Dr. Jamieson asserts that he heard every word of a sermon at a distance of two miles. We have written upon paper manufactured from iron, and have seen a book with leaves and binding of the same material.

INVISIBLE INK FOR POSTAL CARDS.—*The Illustrirte Gewerbezeitung* proposes the use of what may be called "postal card ink," for messages which are sent on such cards or are otherwise unsealed. A solution of nitrate or chloride of cobalt, or chloride of copper, mixed with a little gum of sugar, produces a "magic ink," which is made visible by warming, either by holding against the stove or over a burning match. Potassium ferrocyanide in solution may also be used; but this requires a developer, for which either copper or iron sulphate may be employed. With the former the writing will appear in brown, and with the latter in blue color.

The above are from *Barnes' Educational Monthly.*

THE ADVANCE OF SCIENCE.—In all sciences, but especially in the higher and more complex departments, there are three distinct stages of advance: The first consists in the observation, collection,