

or illustrate, clearly defined in his own mind, else he writes at random. Every subject, however simple, is capable of certain natural divisions. If the learner has these before him, he immediately has something tangible upon which he can work; and he will see that there is something more in writing compositions than merely stringing sentences together. The subject matter must first be attended to; the form of expression is a secondary.—The teacher will find it advantageous to make these divisions for the pupil at first, until he forms the habit of distinguishing the various relations of the parts of any subject, when he will soon learn to lay out his own plan. The benefit the teacher himself will derive from these exercises, will amply repay him for all his labor.

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TALK WITH THE BOYS.

NO. 5.—CARBONIC ACID ALL ALONE—
THE SCIENCE OF BURNING LIME—
THE METAL IN THE GREEK SLAVE.

"Do you want my money, father?"

"Yes, you may bring him up and have him ready here. But first we will have Charles' marble dust and acid; and, John, ask your mother to send up three or four white preserve jars."

"Are you going to get carbonic acid out of sulphuric acid, sir?"

"No; I am going to get it out of marble dust. There is water in marble as there is in almost everything else; but apart from the water (and impurities), every 50 lbs. of marble consists of 22 lbs. of carbonic acid and 28 lbs. of lime. It is the carbonic of lime. If it was a combination of carbon alone with lime it would be the carburet of lime, but combinations with carbonic acid are called carbonates. The lime is composed of oxygen and a white silvery metal called calcium. Calcium, like all the metals, is a simple substance, and you may make a ball, Charles, to represent its atom."

"How heavy must it be, sir?"

"An atom of calcium is a little more than 20 times heavier than an atom of hydrogen, but we will omit the fractions and call it 20 times. It is of the same size. An atom of lime is composed of one atom of calcium, combined with one atom of oxygen; and as the atom of oxygen weighs 8 times more than an atom of hydrogen, the weight of an atom of lime is 28. An atom of carbonate of lime is composed of one atom of carbonic acid which weighs 22 and one atom of lime weighing 28, making the weight of an atom of carbonate of lime 50; so that, in 50 lbs. of pure carbonate of lime, 28 lbs. are lime and 22 lbs. are carbonic acid."

"Shall I mark the calcium ball C?"

"No. You have already marked the carbon ball C; you may mark this Ca, and CaO will stand for oxide of calcium or lime. Have you mixed some water with the sulphuric acid, as I told you?"

"Yes, sir, and it made the bottle very warm."

"Now, pour some of the sulphuric acid upon the marble in the jar."

"How it foams! Look, John."

"Roll up a piece of paper, John; light it at one end and hold the lighted end in the jar."

"What makes it go out so quickly, sir?"

"The carbonic acid, which has been separated from the marble by the sulphuric acid, has filled the jar, pushing out all the air, and nothing will burn in carbonic acid. Throw another handful of the dust into the jar, pour in a little more acid, and then put in the cork that has the india-rubber tube through it, and bend the other end of the tube over into another jar. Now, as the carbonic acid continues to separate from the lime it will flow through the tube and fill the second jar."

"What makes carbonic acid separate from the lime?"

"Lime has a stronger affinity for sulphuric acid than it has for carbonic.—Sulphuric acid is a perfect old Turk; it wants to wed itself to everything that it meets. When it comes in contact with lime, it serves it in the same way that the Roman soldiers of whom you were reading did the inhabitants of Mexico."

"How was that, Charles?"

"They drove off the men, and took possession of their houses and wives."

"Carbon and oxygen are so perfectly united with each other, that they do not care much for other things. Carbonic acid may remain in quiet combination with lime for thousands of years; but if anything that the lime likes better touches it, or if the lime gets into a hot place, the carbonic acid leaves. When you pour the sulphuric acid upon the marble, the lime of the marble enters into combination with the sulphuric acid, and the carbonic acid passes off in the form of gas. The combination of the sulphuric acid and lime forms the sulphate of lime, the same as gypsum or plaster-of-paris."

"Is that jar filled now with something that we cannot see, that 10 minutes ago made a part of solid marble?"

"Even so."

"That is very curious. And the solid part of the marble is a metal?"

"The metal is no more solid than the carbon and oxygen, when all three are combined in the marble. Pure carbon, when it is crystallized, is the hardest substance known. It is then called diamond."

"What sort of a metal is calcium?"

"It is a white metal; it looks somewhat like silver. Its affinity for oxygen is so great that, in the open air, it combines with it very rapidly; in other words, burns right back into lime. This property of oxidizing so readily, entirely destroys the value of pure calcium, though, when combined with oxygen, forming lime, it is of great value for many purposes."

"I never knew before that there was a metal in marble. Has all marble got this metal in it, father?"

"Yes. All marble is the carbonate of lime. Powers' statue of the Greek slave, if it was heated red hot so as to drive off the carbonic acid, would yield about half its weight of first quality lime, suitable for mortar or for white washing. Marble is, in fact, the ore of the metal calcium.

Nearly all the rocks, as well as clay and earth, are metallic ores. Try your lighted paper in the mouth of the second jar, John, and see if that is full yet of the carbonic acid."

"Yes, sir, it puts the paper right out."

"Bring your trap then and drop the mouse into it. Is he alive?"

"Yes, sir; he has eaten up all the pumpkin seed that I gave him. Shall I open the trap and drop him into the jar?"

"Yes; let him go in. How he clings to the wires."

"Why, father! What is the matter with him? He is dead!"

"Yes. I knew he would not live long in that jar. No breathing creature can live in pure carbonic acid. Take up the jar, Charles, very steadily, and pour the gas on the flame of this candle; steadily now, just as if you were pouring water."

"Why! Was that the carbonic acid that put the candle out?"

"Certainly. You did not blow it out did you?"

"No; but it is so strange that I can pour a gas which I cannot see."

"You find this carbonic acid rather a curious substance, do you not? I have explained to you how firmly the carbon and oxygen that compose it are bound together, but next week we will follow it into the growing leaf, and discover the two blades of the invisible shears, that, like the shears of fate, sever even this union asunder."

THE TEACHER.

Who is not a teacher? What of God's creations whether possessing intelligence or not, is not an instructor in the world? The ivy that clings to the broad arms of the forest oak, teaches unmistakably the lesson of dependence. The same oak that supported, while in the pride of strength, the drooping ivy, when rifted by the thunder-bolt conveys forcibly to the mind the weakness of the mightiest, and how vain it is to clothe ourselves in the false glory of our own greatness, and seemingly lose sight of an omnipotent Power. All nature is replete with instructors. And if man will but listen to the teachings, he will never fail to receive lessons of wisdom, whereby to become acquainted with the character and workings of the great Creator.

But, of the instructor of the young mind, we designed to speak more particularly,—of him whose fate it is to encounter the numerous perplexities and difficulties attendant on the teacher's life. We need not here speak of the responsibility of the teacher's position; it has already been written "thread-bare" by abler pens. We speak principally of the evil results following an incorrect knowledge of the real position he should occupy, in relation to his scholars. Not a few instructors of the present day, upon opening their schools full by clothing themselves in their robes of dignified austerity, seemingly desirous of impressing their strange pupils with the conviction that they are no ordinary personages, and nothing but extreme deference on their part will insure them the prospect of a possible existence. This mode of introduction is most admirably