For the EDUCATIONAL REVIEW.]

NATURE STUDY AND SCIENCE.

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Lessons on the Gases of the Air.

(NOTE —Schools which cannot procure the little and inexpensive apparatus required for preparing oxygen on a small scale may begin with Lesson II. Unslacked lime, for preparing limewater, may be obtained at a tannery).

LESSON I.

Collect two or three bottles, wide-mouthed ones, full of oxygen, from chlorate of potash. (See Outlines of Nature Lessons for Grade VII). Show the children by experiment that this gas will allow a stick to burn in it faster than in air—that it will not turn lime-water milky—that a piece of glowing charcoal (held by a wire) will burn brightly in oxygen for a while but will cease to burn before it is all consumed, and that a new gas, which will turn lime-water milky, is formed in the bottle while the charcoal is burning. They will see that the new gas is not charcoal in the gaseous state, for if it were it would become black and solid again as soon as the contents of the bottle cooled, just as steam, which is ice in the gaseous state, would become ice again if cooled down in the vessel in which the ice has been evaporated. The class may be *told* that no one has yet been able to get anything out of charcoal (carbon) but charcoal, nor anything out of oxygen but oxygen.

The argument may then proceed along such a line as this: Since the charcoal and oxygen both disappear, as we see, while the charcoal is burning in the oxygen, we think the new gas must be formed of the carbon and oxygen united together, for it is not the same as either alone.

It will seem strange to the children that a substance so different from carbon or oxygen could be made up of these two elements alone. But they can be led to see that this is quite possible. Char a little starch very slowly in a closed tube. They can soon see drops of clear water from the starch gather on the inside of the tube, and may examine the charcoal which remains at the bottom. *White* starch, then, contains *black* charcoal, and *dry* as the starch was it contained *water*. We say that the charcoal and water in the starch are *chemically united* not simply mixed together, else the starch would be both *black* and *wet*. And so we believe that when the charcoal was burning in the oxygen they were uniting chemically to form the new gas—carbonic acid gas—in which the remaining carbon could not burn, and which turned the lime-water milky. We can now explain, too, why charcoal cannot burn in carbonic acid gas.

LESSON II.

Split up one end of a dry hard-wood stick (about as large as a lead pencil); char this end by holding it in or near a fire; then ignite it and lower it into a wide-mouthed bottle, not too large, full of air, and hold it there until the stick will burn no longer in the bottle. Quickly pour a little clear lime-water into the bottle, cover its mouth tightly with the hand and shake the lime-water through the gases in the bottle until the liquid looks quite milky.

Invite the pupils to ask questions about what they have seen. The following questions will probably be proposed and should be carefully discussed by the pupils and teacher?

Why did the charred stick cease to burn? What was it really doing when it was burning?

Why didn't the lime-water turn milky when shaken through the air at first?

What turned the lime-water milky after the stick had been burning in the bottle?

Discussion.—If the teacher will skilfully direct the children's minds to the main facts to be explained, they will argue themselves into the following conclusions: It must be that the air at first contained something we cannot see (a gas) in which a charred stick will burn—that when the charcoal of the stick is burning it is using up this gas in the air so that soon the stick can burn no longer—that when the burning stick is using up this gas (oxygen) which enables it to burn, a new gas is being produced in which the charcoal will not burn, but which will turn lime water milky—and since lime-water does not turn milky when shaken through air, there cannot be much carbonic acid gas in the air, or at least, that gas does not form more than a small part of the air.

Of course, the arguments leading to these conclusions can be made much clearer and more convincing if the school begins with Lesson I.

Questions for April.

(Answers to all or some of these questions should be sent to the editor of this department by May 15th.)

1. Which of our native trees did you observe in bloom this month? Give the dates, and count (and state) the number of stamens and pistils in a single blossom of each.

2. Make a drawing from the object of a single staminate flower of the willow—of a single pistillate flower—and of one of the bracts.

3. Make a list of the migratory birds you noticed this month. Tell how you recognized each and where you saw it.

4. Describe briefly the first butterfly you see on the wing. Account for its having wings so early.

5. Explain why a stick will not burn in carbonic acid gas. (See preceding lessons).