1. *Oxidation in inorganic materials.* — The effects that have special geological importance are the slow oxidation of iron, manganese, sulphur, and some other elements, which takes place in the mineral constituents of rocks when water and air together have access. Little oxidation takes place under water. The iron of minerals undergoes easy oxidation when it is present in the protoxide state, FeO, or when combined with sulphur. The protoxide state is the unstable state of iron. In oxidizing it combines with one half more oxygen, and becomes the sesquioxide, Fe_2O_3. This iron oxide is the mineral hematite having a red powder, if free from combined water; but, if containing water, limonite, which has a yellow or yellow brown color when powdered, if not before (page 71). The latter rust-colored oxide is like that which is produced when the metal iron rusts. But the rust may contain some carbonate besides the iron sesquioxide.

In a similar manner, when a mineral contains manganese protoxide, MnO, the Mn tends to become Mn_2O_3 or MnO_2, compounds that have a black powder. Black stains, and black crusts on marble and other rocks, after weathering, usually come from the oxidation of some manganese in the rock.

The oxides FeO and MnO are unknown except in combination. But magnetite, Fe_3O_4, is common in disseminated grains in many rocks, besides sometimes constituting thick beds; it often oxidizes slowly to the sesquioxide, Fe_2O_3, producing hematite or limonite.

Again: the iron sulphides, pyrite and marcasite, each FeS_2, oxidize readily, and especially the latter, as shown by Julien; the iron, Fe, becoming FeO, if there is an acid ready to combine with it, but otherwise Fe_2O_3; the sulphur, S, becoming SO_3, and, with added water, sulphuric acid. This acid, with the FeO and water, may make the iron sulphate, copperas; but it may combine also with Fe_2O_3, and make other sulphates. If there is limestone at hand, the SO_3, or sulphuric acid, may combine with the lime and water, and form gypsum, and may thus make beds of gypsum. When pyrite and marcasite are mixed together, the marcasite makes oxidation easy (Julien).

2. *Oxidation in organic materials, and other chemical changes.* — When life ceases, all organic materials tend to decay; and in this decay, oxidation is the chief process, and oxides the larger part, or all, of the final results.

Wood, when thoroughly dried, consists approximately of carbon (C) 49·66, hydrogen (H) 6·21, oxygen (O) 43·03, with traces of sulphur (S) and phosphorus (P), nitrogen (N) 1·10. Animal fats contain the same elements, and animal tissues the same with much nitrogen.

In dried wood, the C, H, O are atomically in the proportions nearly $C_6H_9O_4$. In decay, the oxygen used may be that of the wood, or of the atmosphere or other substances. The C may combine with O and make carbon protoxide, CO, the gas which burns with a blue flame in a furnace; but it generally combines with 2 O, making the more stable and incombustible compound CO_2, or carbonic dioxide (carbonic acid). The H may unite with O and form water, H_2O. But instead of all the C combining