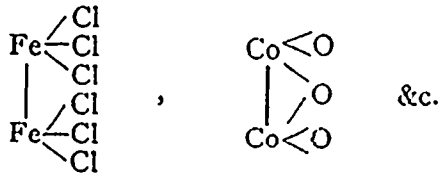
SCIENCE DEPARTMENT.

GROUP IV.

METAS: Zinc, Manganese, Nickel, Cobalt, Iron.

(By Miss Jennie Wood.)

PROPERTIES OF THE GROUP.—The metals of the IV. Group are precipitated by Sulphuretted Hydrogen, H_2S., *completely* out of Alkaline, imperfectly out of Neutral, and not at all out of Acid (strong free acid) Solution. Ammonium Sulphide, NH_4HS (=H_2S and NH_3) produces the same reaction. The precipitated Sulphides (Zn S, Mn S, Ni S, Co S, Fe S) are insoluble in water, but readily soluble in dilute acids (Ni S and Co S difficultly soluble). Ammonium Sulphide, NH_4HS, distinguishes the metals of this Group from those of I. and II. Groups, which were *non-precipitable*, and from those of the III. Group, which were precipitable not as Sulphides but as Hydroxides. The metals of this Group are bivalent, quadrivalent or sexivalent. Zinc is always bivalent, Zn O being its only oxide. Manganese, Nickel, Cobalt and Iron are bivalent in their Manganous (Mn O, Mn Cl_2, &c., &c.), Nickelous (Ni O, Ni Cl_2 &c.), Cobaltous (Co O, Co Cl_2, &c.) and Ferrous (Fe O, Fe Cl_2, &c.) compounds, and *quadrivalent* in their Manganic (Mn_2O_3, Mn_2Cl_6, &c.), Nickelic (Ni_2O_3), Cobaltic (Co_2O_3) and Ferric (Fe_2O_3, $Fe_2(SO_4)_3$, Fe_2Cl_6) compounds. It is by the union of two atoms by one combining power that the hexad group is formed :—



&c.

Cobalt and Nickel are bivalent in their ordinary salts, the peroxides or sesquioxides, Co_2O_3, and Ni_2O_3, losing oxygen at a red heat. Besides these oxides, the *tetradic* combinations of Nickel and Cobalt are *very few*. Manganese and Iron are also sexivalent—Manganese Sex-fluoride Mn F_6, Potassium Manganate $K_2Mn\,O_4$, and Potassium Ferrate $K_2Fe\,O_4$