H2W4O13+ 7H2O. This acid forms crystals of the stated composi­tion ; it dissolves in water and the solution unites with bases into meta-tungstates. Most meta-tungstates are soluble in water ; of the tungstates proper only the alkali salts are so soluble. The soda tungstate, 5Na2O.12WO3 + *x*H2O, known as para-tungstate of soda, is made industrially by fusing wolframite with carbonate of soda and lixiviating the fuse with water. The insoluble oxides of iron and manganese are filtered off ; the filtrate, while still hot, is nearly neutralized with hydrochloric acid and allowed to crystallize. It forms large crystals containing twenty-one, twenty-five, or twenty­eight times H2O according to the temperature at which they are formed. The salt has been recommended as a mordant in dyeing and calico-printing, but has not taken root in these industries. Oppenheim and Versmann recommended it before 1862 as the best means for rendering textile fabrics uninflammable. If a solution of the para-tungstate is boiled with hydrated tungstic acid (as ob­tained by precipitating any ordinary alkaline tungstate solution with hydrochloric acid in the heat), or is simply mixed with excess of acetic acid, the meta-tungstate is formed ; in the latter case it separates out as a heavy oil. Meta-tungstate of soda forms octa­hedral crystals of the composition Na2O. 4WO3 + 10H2O. If con­centrated warm solutions of this salt and the equivalent quantity of chloride of barium are mixed and allowed to cool after addition of a little hydrochloric acid, meta-tungstate of barium crystallizes out as BaO. 4WO3 + 9H2O, in large quadratic pyramids which are very easily soluble in water. From this salt the free acid is easily produced by addition of the exact quantity of sulphuric acid re­quired to precipitate the baryta, and from it any other meta­tungstate is easily produced. Meta-tungstic acid solution is a sensitive and characteristic precipitant for almost all alkaloids (strychnine, quinine, &c.). The alkaloid, whatever its name, goes down as a flocculent insoluble meta-tungstate. Tungstic acid com­bines with phosphoric acid and with silicic acids into highly com­plex phospho-tungstic acids and silico-tungstic acids. Of the for­mel· there is quite a series, each consisting of one P2O5 united with respectively fourteen, sixteen, eighteen, twenty, twenty-two, twenty- four times WO3 and six H2O of basic water. Of silico-tungstic acids three are known, namely, one 4H2O . SiO2.10WO3 + 3Aq and two SiO2. 12WO3*x*H2O. All these complex acids (both kinds) are easily soluble in water. The phospho-acids are delicate precipitants for all alkaloids.

The binoxide, WO2, is obtained when the trioxide is reduced by hydrogen at a dull red heat. This oxide is very prone to pass into trioxide or tungstate. An interesting and beautiful class of com­pounds of WO3, WO2, and bases are known as tungsten bronzes. The first of these was discovered by Wohler. Normal tungstate of soda, Na2OWO3, is fused, and trioxide added to it as long as it dissolves. The product is then heated in hydrogen as long as water goes away, and the substance thus reduced is exhausted successively with water, hydrochloric acid, caustic potash ley, and again with water. A residue of the composition Na2O. W2O6 +WO2 remains in the shape of magnificent gold-like lustrous cubes, of specific gravity 6∙617, which conduct electricity like a metal. Only hydrofluoric acid dissolves this soda-tungsten bronze. There are a number of other tungsten bronzes, all distinguished by metallic lustre and magni­ficent purple, red, yellow, or blue colours.

*Analysis.—*Oxides of tungsten dissolve in fused microcosmic salt, Na2OP2O5 ; the bead becomes blue in the reducing flame, in the presence of iron blood-red, and in the oxidizing flame colourless. When heated on charcoal with (not too much) carbonate of soda or cyanide of potassium in the reducing flame, they yield a grey heavy powder of metal, obtainable by elutriation. The process fails in the presence of too much alkali. Insoluble tungstates *(e.g.,* the ordi­nary tungsten minerals) are disintegrable by fusion with alkaline carbonate ; the fuse, when treated with water, yields a solution of alkaline tungstate. This solution, when mixed with excess of hydro­chloric acid, gives a white precipitate of hydrated trioxide, which on boiling becomes yellow by partial dehydration. The yellow unignited precipitate is soluble in aqueous ammonia. If tungstate of alkali solutions are mixed with hydrochloric acid and then treated with metallic zinc, they become blue through the formation of a compound of WO3 and WO2 or rather the respective chloride ; this reaction gains in definiteness through the presence of phosphoric acid. (W. D.)

TUNGUSES, a wide-spread Asiatic people, forming a main branch of the Mongol division of the Mongol-Tatar family. They are the *Tung-hu* of the Chinese, probably a corrupt form of *tonki* or *dοnki,* that is, “men” or “people.” The Russian form *Tungus,* wrongly supposed to mean “lake people,” appears to occur first in the Dutch writer Massa (1612); but the race has been known to the Russians ever since they reached the Yenisei. The Tungus domain, covering many hundred thousand square miles in central and east Siberia and in the Amur basin, stretches from the Yenisei eastwards to the Pacific, where it occupies most of the seaboard between Corea and Kamchatka. It also reaches the Arctic Ocean at two points, in the Nisovaya tundra, west of the Khatanga river, and in a comparatively small enclosure in the Yana basin over against the Liakhoff (New Siberia) Archipelago. But the Tunguses proper are chiefly centred in the region watered by the three large eastern tributaries of the Yenisei, which from them take their names of the Upper, Middle or Stony, and Lower Tunguska. Here the Tunguses are known to the Samoyedes by the name of *Aiya* or “younger brothers,” implying a comparatively recent immigration (confirmed by other in­dications) from the Amur basin, which appears to be the original home both of the Tunguses and of the closely- allied Manchus. The Amur is still mainly a Tungus river almost from its source to its mouth : the Oroches (Orochus), Daurians, Birars, Golds, Manegrs, Sanagirs, Ngatkons, Nigidals, and some other aboriginal tribes scattered along the main stream and its affluents,—the Shilka, Sungari, and Usuri,—are all of Tungus stock and speech. On the Pacific the chief subdivisions of the race are the Lamuts, or “ sea people,” grouped in small isolated hunting communities round the west coast of the Sea of Okhotsk, and further south the Yu-pi-ta-tze (“fish clad”), the Tazi of the Russians, between the Amur delta and Corea. The whole race, exclusive of Manchus, numbers probably about 80,000, of whom 15,000 are in the Amur basin, the rest in Siberia.

The Tungus type is essentially Mongolie, being characterized by broad flat features, small nose, wide mouth, thin lips, small black and somewhat oblique eyes, black lank hair, dark olive or bronze complexion, low stature, averaging not more than five feet four inches ; they are distinguished from other Mongolic peoples by the square shape of the skull and the slim, wiry, well-proportioned figure. This description applies more especially to the Tunguska tribes, who may be regarded as typical Tunguses, and who, unlike most other Mongols, betray no tendency to obesity. They are classed by the Russians, according to their various pursuits, as Reindeer, Horse, Cattle, Dog, Steppe, and Forest Tunguses. A few have become settled agriculturists ; but the great bulk of the race are still essentially forest hunters, using the reindeer both as mounts and as pack animals. Nearly all lead nomad lives, in pursuit of fur-bearing animals, whose skins they supply to Russian and Yakut traders, in exchange for provisions, clothing, and other necessaries of life. The picturesque and even elegant national costume shows in its ornamentation and general style decided Japanese influence, due no doubt to long-continued intercourse with that nation at some period previous to the spread of the race from the Amur valley to Siberia. Many of the Tungus tribes have been baptized, and are, therefore, reckoned as “Greek Christians’’; but Russian orthodoxy has not penetrated far below the surface, and most of them are still at heart Shamanists and nature-worshippers, secretly keeping the teeth and claws of wild animals as idols or amulets, and observing Christian rites only under compulsion. But, whether Christians or pagans, all alike are distinguished above other Asiatics, perhaps above all other peoples, for their truly noble moral qualities. All observers describe them as "cheerful under the most depressing circumstances, persevering, open-hearted, trustworthy, modest yet self-reliant, a fearless race of hunters, boni amidst the gloom of their dense pine-forests, exposed from the cradle to every danger from wild beasts, cold, and hunger. Want and hardships of every kind they endure with surprising fortitude, and nothing can induce them to take service under the Russians or quit their solitary wood­lands” (Keane’s *Asia,* p. 479). Their numbers are steadily de­creasing owing to the ravages of small-pox, scarlet fever, and especially famine, their most dreaded enemy. Their domain is also being continually encroached upon by the aggressive Yakuts from the north and east, and from the south by the Slavs, now settled in compact bodies in the province of Irkutsk about the upper course of the Yenisei. It is remarkable that, while the Russians often show a tendency to become assimilated to the Yakuts, the most vigorous and expansive of all the Siberian peoples, the Tunguses everywhere yield before the advance of their more civilized neighbours or become absorbed in the surrounding Slav communities. In the Amur valley the same fate is overtaking the kindred tribes, who are disappearing before the great waves of Chinese migration from the south and Russian encroachments both from the east and west. In 1880 the Oroches were already reduced to about 260, and the Tazi to a little over 200. For the philological relations of the Tunguses, see vol. xviii. p. 779.