

Group 8 - 10 / VIII B; Iron - Platinum Group

The Iron - Platinum Group is often subdivided into the iron group proper (group 8) containing iron (Fe), cobalt (Co) and nickel (Ni), and the platinum group with ruthenium (Ru), rhodium (Rh), palladium (Pd), Osmium (Os), iridium (Ir) and platinum (Pt). Here we treat them in one module.

Nothing need to be said about the importance of iron. Nickel is not only an important alloy element in steel (in particular in [stainless steels](#)) but in the base element for what are called "super-alloys", indispensable materials for high-temperature applications like in jet turbines. Cobalt also has many applications of its own.

Iron, nickel and cobalt are the only elements that are ferromagnetic at reasonable temperatures and thus often found in magnetic (and thus also electric) machinery and products.

The platinum group elements are all more or less noble metals, rare and expensive. Besides being used in jewelry, platinum is of extreme technical importance as a kind of universal catalyst for all kind of processes. It is part of the exhaust clean-up system of your present car and will be part of the fuel cells that power (perhaps) the cars of the future. Palladium also finds unique and substantial technical uses.

Table of Basic Data

Name (German)	Iron <i>Eisen</i>	Cobalt <i>Cobalt</i>	Nickel <i>Nickel</i>	Ruthenium <i>Ruthenium</i>	Rhodium <i>Rhodium</i>	Palladium <i>Palladium</i>	Osmium <i>Osmium</i>	Iridium <i>Iridium</i>	Platinum <i>Platin</i>
Atomic number	26	27	28	44	45	46	76	77	78
Atomic mass [u]	55,85	58,93	58,69	101,07	102,91	106,42	190,2	192,22	195,08
Melting point [K]	1808	1768	1726	2583	2239	1825	3318	2683	2045
Melting point [°C]	1535	1495	1453	2310	1966	1552	3045	2410	1772
Melting point [°F]	2795	2723	2647	4190	3625	2825	5513	4370	3221
Boiling point [K]	3023	3143	3005	4173	4000	3413	4300	4403	4100
Density [g/cm ³]	7,87	8,89	8,91	12,45	12,41	12,02	22,61	22,65	21,45
Ionization energy [eV]	7,87	7,86	7,64	7,37	7,46	8,34	8,7	9,1	9,0
Electronegativity	1,6	1,7	1,8	1,4	1,5	1,4	1,5	1,6	1,4
Atomic radius [pm]	124,1	125,3	124,6	134	134,5	137,6	135	135,7	138
Ionic radius [pm]	67	82	78	77	75	86	67	66	85
Oxidation numbers	6 bis -2	5 bis -1	4 bis -1	8 bis -2	6 bis -1	4 bis 2	8 bis -2	6 bis -1	6 bis 2
Lattice type Transformation temp. [°C]	bcc 1402 fcc 910 bcc	fcc 440 hcp	fcc	hcp	fcc	fcc	hcp	fcc	fcc ?
Lattice constant [Å] (a or c)	2,86	2,51 4,07	3,52	2,70 4,27	3,80	3,88	2,73 4,31	3,83	3,92
Young's - Modulus [GPa]	213	204	202	(432)	379	113	560	528	168

Therm. expansion coefficient α [10^{-6}K^{-1}]	14,0	12,0	12,5	9,8	8,5	11,2	?	6,6	8,94
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- In case of doubt all numbers are for room temperatures
- fcc = [face centered cubic](#); lattice const. = a
 bcc = [body centered cubic](#)
 sc = [simple cubic](#)
 hp = simple [hexagonal](#)
 hcp = [hexagonal close packed](#); lattice constants a and c.
 op = [simple orthorhombic](#), [monoclinic](#), [triclinic](#)
 tp = [simple tetragonal](#)
 dia = [diamond structure](#)
 r = [trigonal](#) or rhomboedral trigonal