Group 14 / IVA; Carbon Group

Basics

- This is the by far most important group. After all, you and me are carbon-based life forms. Without carbon (C) no biology, without silicon (Si) no Internet, electronics, computer tomography and so on.
  - I don't have to emphasize the importance of carbon -based organic chemistry, but let's not forget that the inorganic iron (Fe) based "chemistry" is still more important. Elementary clean carbon in the form of graphite is very important for parts of the high-tech industry, and elemental carbon in the form of diamonds are girl's best friends.
    Dirty carbon in the form of coal, while killing the climate, is still indispensable for the wealth of nations.
  - Most of the silicon produced is not used for microelectronics or solar cells bit for steel making. A rather large part also goes into making silicones, oily or putty-like stuff, that does not only wonders to female profiles but is a high-tech material with rapidly growing applications.
    And let's not forget that all glasses and a lot of ceramics contain large quantities of silicon.
  - Germanium (Ge) is used for some rather special applications an small quantities, but tin (Sn) and leaf (Pb) were and are metals of importance. Solder, a trivial but important part of all electronics, was a tin-lead alloy until recently. Since lead and many of its compounds are rather poisonous, lead is being phased out right now.
  - Tin was the essential alloy element for good bronze (a copper (Cu) tin (Sn) alloy). It was the essential strategic metal in the bronze age; mined in remote locations (like England) and traded across huge distances more than 3.000 years ago. In oxide (SnO_2l is just about now starting a potentially big career as semiconductor.
- *Table of Basic Data*.

Name *(German)*	**Carbon** *Kohlenstoff*	**Silicon** *Silicium*	**Germanium** *Germanium*	**Tin** *Zinn*	**Lead** *Blei*
Atomic number	6	14	32	50	82
Atomic mass [u]	12.01	28,09	72,61	118,71	207,2
Melting point [K]	3823	1683	1210,55	505,12	600,65
Melting point [^oC]	3550	1410	937,55	232,12	327,65
Melting point [^oF]	6422	2570	1719.5	450	622
Boiling point [K]	5100	2628	3103	2543	2013
Density [g/cm^3]	3,51	2,33	5,32	7,29	11,34
Ionization energy [eV]	11,26	8,15	7,90	7,34	7,42
Electronegativitiy	2,5	1,7	2,0	1,7	1,6
Atomic radius [pm]	77,2	117	122,5	140,5	175,0
Ionic radius [pm]	16	26	53	93	132
Oxidation numbers	4, 2, -4	4, -4	4, 2	4, 2	4, 2
Lattice typ **Transformation temp. [^{o} C]**	dia ? hcp	dia	dia	tp 13 dia	fcc
Lattice constant [Å] **(a or c)**	? ?	5,43	5,66	5,82 3,18	4,95

Young's - Modul us [GPa]	?	13	?	54,3	16,2
Therm. expansion coefficient α [$10^{-6}K^{-1}$]	?	?	?	?	28

- 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