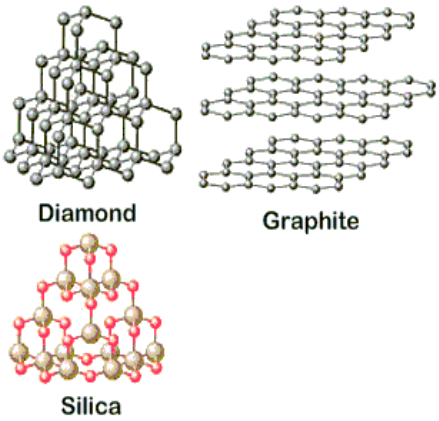
Types of Solids

COVALENT NETWORK

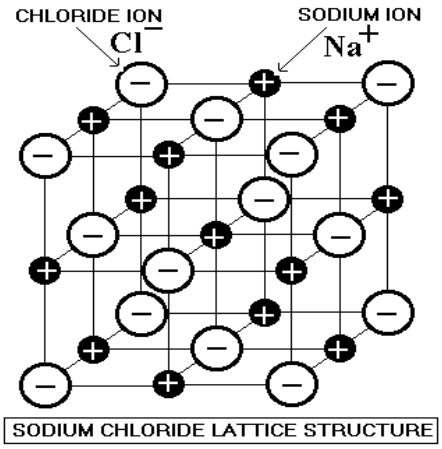


intramolecular* ➜ covalent
intermolecular* ➜ N.A.
*graphite covalent intraplanar v.d.W interplanar
lattice points: occupied by neutral atoms (C or Si and O)

conductivity*: N.A. (atoms neutral, electron locked in bonds)
* graphite resonant pi electrons allow for conductivity through planes, no conductivity between planes (anisotropic)

solubility: N.A. (replacement force for a covalent bond is next to impossible)

IONIC

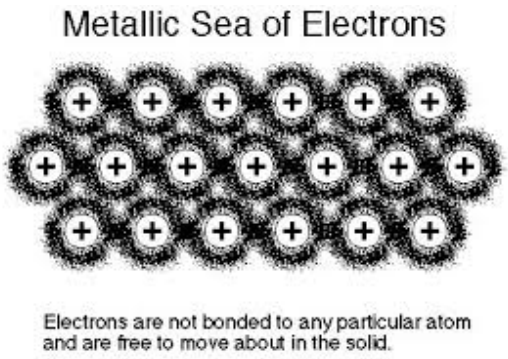


intramolecular ➜ ionic bond
intermolecular ➜ N.A.
lattice points: occupied by ions (Na^{1+} Cl^{1-})
{if NH_4NO_3 include an intraionic cov. bond}

conductivity:
(s) non-conductive (ions locked in lattice, electrons held tight in ions)
(l) moderately conductive (Na^{1+} and Cl^{1-} ions free to move)
(aq) moderately conductive (hydrated Na^{1+} ions and Cl^{1-} free to move)

solubility in water: variable depending on hydration energy vs lattice energy (i.e. are there adequate replacement forces), units are individual hydrated ions (i.e. Na^{1+} & Cl^{1-}) {if NH_4NO_3 units would be NH_4^{1+} and NO_3^{1-}}
solubility in non-polar: nil

METALLIC



intramolecular ➜ metallic bond
intermolecular ➜ N.A.
lattice points: occupied by individual metallic ions

conductivity: excellent in (s) and (l) states due to highly mobile free moving electrons

solubility: soluble in other metals only once warmed past melting point (an alloy is a metallic solution of more than one type of metal – also see mercury amalgam, units are individual metal ions

MOLECULAR

intramolecular ➜ covalent bond
intermolecular ➜ depends on molecules (ice has an H-bond, I_2 would be v.d.W only)
lattice points: occupied by individual molecules

conductivity: nil in solid state, if molecule is polar and capable of ion dissociation, slight conductivity is observed in the liquid state

solubility: if replacement forces are adequate (similar polarity and similar new intermolecular forces) can be highly soluble, units will be individual molecules (molecules do not fall apart due to covalent bond framework)