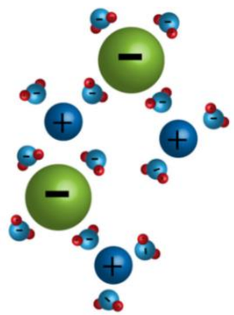
shapes of molecules	polarity of molecules	solubility of ionic solid in water	insolubility of ionic solid in cyclohexane
around the central ….. atom # of regions of electron density repel – for maximum separation / to minimise repulsion into ….. electron geometry with bond angle …..° # bonding and # nonbonding regions leads to ….. molecular shape	X–Y bond is polar different atoms have different EN / X is more / less EN than Y bond is / has a dipole dipoles are the same / different dipoles are arranged symmetrically / asymmetrically around central atom dipoles cancel out / don't cancel out so molecule is nonpolar / polar overall	water is polar +ve H ends attracted to –ve ions –ve O ends attracted to +ve ions attraction sufficient to overcome solute–solute attraction between +ve and –ve ions ions removed from lattice ionic solid <u>can dissolve</u>	cyclohexane is nonpolar attractive forces formed with ions in ionic lattice are NOT strong enough to overcome strong ionic bonds ionic solid <u>will not</u> dissolve
Electron geometry & bond angles • Linear 180° • Trigonal planar 120° • Tetrahedral 109° **Molecular shapes** • Bent (120° or 109°) depending on the electron geometry • Trigonal planar • Trigonal pyramidal • Tetrahedral	**Electronegativity (EN)** • X–X nonpolar bond (identical atoms) • X–Y and X–Z polar bonds; dipoles are different as Y and Z have different EN • EN increases from left to right across a period AND EN decreases going down a group • some EN that are useful to remember: $F > O > N \approx Cl > S \approx C > P \approx H$ where F is most EN	to dissolve any substance the new solute–solvent attractions must form strong enough attractions to overcome the existing solute–solute and solvent–solvent attractions 	to dissolve any substance the new solute–solvent attractions must form strong enough attractions to overcome the existing solute–solute and solvent–solvent attractions

<table>
<tr><th>nonpolar solid insol. in H_2O / sol. in cyclohexane</th><th>low m.pt. and b.pt. of molecular solids</th><th>electrical conductivity of molecular solid</th><th>electrical conductivity of ionic solids</th></tr>
<tr><td rowspan="3">to dissolve, need to overcome existing solute–solute and solvent–solvent attractions
water is polar solvent
attractive forces of nonpolar solid with water are weaker than existing attractive forces within each substance
nonpolar solid does NOT dissolve in water
WHEREAS
cyclohexane is nonpolar solvent
solute and solvent are both non-polar molecules
attractive forces formed between particles are strong enough to overcome the existing attractive forces within each substance
nonpolar solid can dissolve in cyclohexane</td><td>molecular solid
weak intermolecular attractions between molecules
little heat energy is required to overcome these attractions
therefore low m.pt. / b.pt.</td><td>mobile charged particles required for electrical conductivity
molecular solid
weak intermolecular attractions between molecules
no free moving charged particles (no ions or electrons)
unable to conduct electricity in any state</td><td>mobile charged particles required for electrical conductivity
(3D lattice of) alternating cations and anions
held together by (strong) ionic bond
as solid: ions cannot move
molten and/or aqueous: now ions can move and can pass electric current</td></tr>
<tr><th>brittleness of ionic solids</th><th>electrical conductivity of diamond and silicon dioxide</th><th>electrical conductivity of graphite</th></tr>
<tr><td>(3D lattice of) alternating cations and anions
held together by (strong) ionic bond
if a force is applied
ions with same charge are brought next to each other
like charges repel
shatters the structure</td><td>mobile charged particles required for electrical conductivity
covalent network substance
3-D lattice of atoms covalently bonded in a tetrahedral arrangement
no charged particles free to move
so unable to conduct electricity.</td><td>mobile charged particles required for electrical conductivity
covalent network substance
each C atom bonded to 3 other carbon atoms in hexagonal layers.
one delocalised electron per C atom is mobile
able to carry a charge so conducts electricity</td></tr>
</table>

Malleability/ductility of metals	High m.pt of metals	Conductivity of metals	High m.pt of ionic solids
(lattice of) metal cations sea of delocalised electrons held together by (strong) metallic bond bond is nondirectional bonding electrons delocalised across the lattice if force applied, particles can move past each other without disrupting the bonding	metallic solid (lattice of) metal cations in sea of delocalised electrons held together by (strong) metallic bonds lot of heat energy is required to break these bonds therefore high m.pt.	mobile charged particles required for electrical conductivity (lattice of) metal cations in sea of delocalised electrons delocalised electrons can move allows metals to conduct electricity in any state	ionic solid (3D lattice of) alternating cations and anions held together by (strong) ionic bonds lot of heat energy required to break these bonds therefore high m.pt.