

# Characteristics of Crystals

(reference: class notes and discussion, pg. 374-375)

Crystal type	Particles in crystal	Attractions between particles	Melting/boiling point	Electrical conductivity	Texture and solubility	Condition for formation	Example
Metallic							
Network solids							
Ionic							
Molecular (polar)							
Molecular (non-polar)							

Place a number (corresponding to the descriptions below) in each of the boxes in the chart

<p><b><u>Particles in crystal</u></b></p> <ol style="list-style-type: none"> <li>Atoms or non-polar molecules</li> <li>Positive nuclei surrounded by a sea of negative electrons</li> <li>Atoms</li> <li>Polar molecules</li> <li>Positive and negative ions</li> </ol> <p><b><u>Attraction between particles</u></b></p> <ol style="list-style-type: none"> <li>Electrostatic attraction between instantaneous or induced dipoles (weak London forces)</li> <li>Metallic bond (strong)</li> <li>Electrostatic attraction between ions</li> <li>Electrostatic attraction between dipoles (moderately strong dipole-dipole, or slightly stronger H-bonding)</li> <li>Covalent bonds (strong)</li> </ol> <p><b><u>Melting/boiling point (relative)</u></b></p> <ol style="list-style-type: none"> <li>Highest</li> <li>High</li> <li>Intermediate to high</li> <li>Low to intermediate</li> <li>Lowest</li> </ol> <p><b><u>Electrical conductivity</u></b></p> <ol style="list-style-type: none"> <li>Good conductor</li> <li>Conducts only when melted or dissolved in water</li> <li>Low conductivity</li> <li>Extremely low conductivity (has insulating properties)</li> <li>Generally does not conduct (graphite is the exception – pg. 860)</li> </ol>	<p><b><u>Texture and solubility</u></b></p> <ol style="list-style-type: none"> <li>Some of the hardest compounds known. Insoluble.</li> <li>Soft. Soluble in polar solvents, insoluble in non-polar solvents.</li> <li>Soft to hard. Malleable and ductile. Insoluble in polar and non-polar solvents. (soluble in molten metals)</li> <li>Hard and brittle. Dissolves in polar solvents such as water.</li> <li>Very soft. Insoluble in polar solvents, soluble in non-polar solvents.</li> </ol> <p><b><u>Conditions for formation</u></b></p> <ol style="list-style-type: none"> <li>Formed from atoms, or molecules whose atoms are similar in electronegativity</li> <li>Formed between atoms of widely differing electronegativities (i.e. metal + non-metal)</li> <li>Formed between molecules with polar covalent bonds (atoms in molecule have moderate differences in electronegativity).</li> <li>Usually formed from group IVA elements, or from elements/molecules that can bond in four directions.</li> <li>Formed by one or more elements with low electronegativities.</li> </ol> <p><b><u>Examples</u></b></p> <ol style="list-style-type: none"> <li>Ice</li> <li>Diamond or sand (silicon dioxide)</li> <li>Table salt</li> <li>Frozen oxygen, wax (made up of long hydrocarbon chains)</li> <li>A copper penny</li> </ol>
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Check your work: the numbers in each row should add up to 126