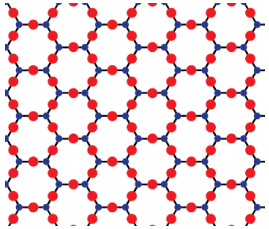
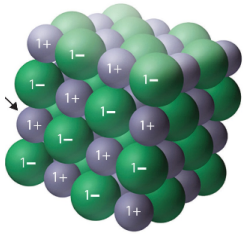
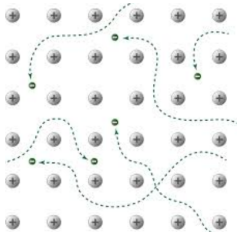
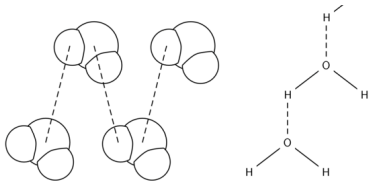
Covalent Bonding (Network)	Covalent Bonding (Molecular)	Ionic Bonding	Metallic Bonding
<u>Ductile and Malleable</u> Can be drawn into wires and bend because the electrons flow freely and can act as a cushion to prevent cations from getting too close and repelling/breaking. **Hardness**	<u>Hard & Strong</u> All atoms are held in place by strong covalent bonds. **Hardness**	<u>Soft & Brittle</u> Weak intermolecular forces mean molecules are not held together tightly. **Hardness**	<u>Hard & Brittle</u> Bonds resist being stretched because they are held together by electrostatic force. Easily Cracked If the lattice is offset the cations can align and repel one another causing the solid to crack. **Hardness**
Metal & a non metal **Occurs Between**	Non-metal and a non-metal **Occurs Between**	Metal & metal **Occurs Between**	Non-metal and a non-metal **Occurs Between**

Poor Electrons are held in bonds so they do not flow freely. **Electrical Conductivity**	Poor when solid Cannot conduct electricity when solid because electrons are held in place. Good when molten/liquid Can conduct electricity when molten because electrons can move around easily. Good when dissolved in water. H_2O pulls ions out of lattice allowing electrons to flow freely. **Electrical Conductivity**	Good Electrons flow freely so it can easily conduct electricity. **Electrical Conductivity**	Poor Electrons are held in bonds so they do not flow freely. **Electrical Conductivity**
Atoms are bonded by covalent bonds in a continuous network extending throughout the material. **Structure**	Individual molecules are held in place by weak intermolecular forces. **Structure**	Crystalline, but not crystals. Spheres of equal size naturally form close packed arrangement. **Structure**	Crystalline Lattice. **Structure**
Insoluble Water dipoles cannot pull covalently bonded atoms out of their system. **Solubility**	Soluble Water's strong dipoles can pull atoms out of their crystalline lattice separating them, despite the strong electrostatic force holding them together. **Solubility**	Insoluble Sometimes these solids will react with water, but they do not dissolve in water. **Solubility**	Solubility depends on polarity of the molecule. Polar molecules will dissolve in water, non-polar molecules will not. **Solubility**

 **Diagram**	 **Diagram**	 **Diagram**	 **Diagram**
Variable. **Melting/ Boiling Point.**	High melting and boiling point because all atoms are held together by strong bonds that would need to be broken in order for the substance to melt or boil. **Melting/Boiling Point**	Low melting and boiling point because it does not take a lot of energy to separate the weak intermolecular forces holding the molecules in place. **Melting/Boiling Point**	High melting and boiling point because electrostatic forces take a lot of heat energy input to separate (they resist being pulled apart). **Melting/Boiling Point**
Electrons are completely transferred from one atom to another. Ex. **Electron Behaviour**	Elections are shared between atoms. Ex. **Electron Behaviour**	"Sea" of electrons floating around positively charged cations. **Electron Behaviour**	Electrons are shared between atoms but may be slightly more attracted to one atom. Can form single, double or triple bonds. Ex. **Electron Behaviour**