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| **Topic** | Bonding, structure and physical properties | **Level** | GCSE |
| **Outcomes** | 1. To describe the structure and bonding of metallic, ionic and covalent compounds 2. To relate the structure and bonding of a substance to its properties | | |

**Progress:** further resources on bonding are available here [www.thescienceteacher.co.uk/bonding/](http://www.thescienceteacher.co.uk/bonding/)

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|  | **Metallic** | **Ionic** | **Giant Covalent** | **Simple Molecular** |
| **Present** | Metals only | Metals and Non-metals | Non-metals only | Non-metals only |
| **Bonding** | Metallic | Ionic | Covalent | Covalent |
| **Structure** | Giant lattice | Giant lattice | Giant lattice | Simple molecular |
| **Made up of** | Positive metal ions and delocalized electrons | Positive metal ions and negative non-metal ions | Atoms | Molecules |
| **Diagram** |  |  | See specific examples of diamond, graphite and silicon dioxide |  |
| **Properties** | 1.High melting and boiling point  2. Good conductor of electricity  3. Malleable (easy to be bent and shaped) | 1.High melting and boiling point  2. Good conductor of electricity when dissolved in water or molten | 1. High melting and boiling points  2. Most do not conduct (the exception is Graphite) | 1. Low melting and boiling points  2. Do not conduct electricity |
| **Explanation of properties** | 1. Lots of energy needed to break strong metallic bonds  2. Metals have delocalized electrons that are free to move throughout and carry an electric current  3. Metal atoms are arranged in layers that are able to slide over each other. | 1. Lots of energy needed to break the strong bonds between the positive and negative ions.  2. When Ionic compounds dissolve or melt the ions are free to move and carry an electric current. | 1. Lots of energy needed to overcome the strong covalent bonds.  2. No free electrons (except in graphite) | 1. Weak intermolecular forces that require very little energy to be broken.  2. No free electrons |
| **Examples** | gold, platinum, iron | sodium chloride, potassium flouride,  magnesium oxide | diamond, graphite,  silicon dioxide | chlorine, oxygen,  hydrogen, helium |