Chemistry 2.4 AS 91164 Demonstrate understanding of bonding, structure, properties and energy changes

Writing Excellence answers to **Solids – Conductivity (Ductility)** questions

Solids – Conductivity (Ductility) QUESTION

Question: Using your knowledge of structure and bonding, explain why, although both graphite and copper are good **conductors** of electricity, copper is suitable for **electrical wires**, but graphite is not. (note two properties to discuss)
(you will need to fill in the chart below correctly as part of the question and use the terms in your answer)

Substance	Type of substance	Type of particle	Attractive forces between particles
$C_{(s)}$ Graphite	Covalent network	Atom	Covalent (and weak intermolecular forces)
$Cu_{(s)}$ copper	metal	Atom / cations and electrons	Metallic bonds / electrostatic attraction

ANSWER	
1. For the first substance (name) state the **type of solid** that it is	**Graphite** is a **covalent network** solid
2. describe the **structure** of this type of substance using the *terms* above in the table	composed of layers of C atoms covalently bonded to three other C atoms. The remaining valence electron is delocalised (ie free to move) between layers;
3. explain how the **bonding** relates to the present of free moving charged particles to conduct electricity in your substance (property 1)	The delocalised electrons are able to carry an electrical charge
4. link to the **observation** (conductivity) in your question for the first substance	Therefore graphite is **able to conduct** electricity
5. explain how the **bonding** relates to ductility in your substance (property 2)	In graphite, the attractive forces holding the layers together are very weak and are broken easily, so the layers easily slide over one another,
6. link to the **observation** (forming wires) in your question for the first substance	but the attraction is not strong enough to hold the layers together and allow it to be drawn into wires or although the layers can slide due to weak forces, if graphite was to be made into a wire the very strong covalent bonds within the layers would have to be broken. Graphite **cannot form wires.**
7. For the second substance (name) state the **type of solid** that it is	**Copper** is a **metallic** substance
8. describe the **structure** of this type of substance using the *terms* above in the table	composed of copper atoms packed together. Valence electrons are loosely held and are attracted to the nuclei of the neighbouring Cu atoms ;ie the bonding is non-directional.
9. explain how the **bonding** relates to the present of free moving charged particles to conduct electricity in your substance (property 1)	These delocalised valence electrons are free moving and can carry a charge
10. link to the **observation** (conductivity) in your question for the second substance	Therefore copper is **able to conduct** electricty
11. explain how the **bonding** relates to ductility in your substance (property 2)	In copper, the non-directional metallic bonding holds the layers together, allowing it to be stretched without breaking.
12. link to the **observation** (forming wires) in your question for the second substance	Therefore Copper metal is malleable and can **easily be drawn into wires** since, as it is stretched out,

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.