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

Writing Excellence answers to **Solids – Solubility** questions

Solids – Solubility QUESTION

Question: Justify this statement in terms of the particles, structure, and bonding of these solids. You may use diagrams in your justification.
Potassium chloride is soluble in water while Silicon dioxide and copper are insoluble in water
(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
$KCl_{(s)}$ potassium chloride	ionic	ion	Ionic bonds / electrostatic attraction
$SiO_{2(s)}$ silicon dioxide	Covalent network	atoms	covalent
Cu(s) copper	metal	atom	Metallic bonds / electrostatic attraction

ANSWER	
1. For the first substance (name) state the **type of solid** that it is	$KCl_{(s)}$ potassium chloride is an ionic solid.
2. describe the **structure** of this type of substance using the *terms* above in the table	KCl is made up of positive K^+ ions, and negative Cl^- ions, ionically bonded in a 3D lattice.
3. explain how the **bonding** relates to the attraction between particles in your substance and water particles	When added to water, polar water molecules form electrostatic attractions with the K^+ and Cl^- ions. The partial negative charge, δ^-, on oxygen atoms in water are attracted to the K^+ ions and the partial positive, δ^+, charges on the H's in water are attracted to the Cl^- ions,
4. link to the **observation** (solubility) in your question for the first substance	causing KCl to dissolve in water, and **therefore be soluble**
5. For the second substance (name) state the **type of solid** that it is	$SiO_{2(s)}$ silicon dioxide is a covalent network solid.
6. describe the **structure** of this type of substance using the *terms* above in the table	$SiO_{2(s)}$ is made up of atoms covalently bonded together in a 3D lattice structure.
7. explain how the **bonding** relates to the attraction between particles in your substance and water particles	(Covalent bonds are strong), Polar water molecules are not strong / insufficiently attracted to the Si and O atoms,
8. link to the **observation** (solubility) in your question for the second substance	therefore **SiO_2 is insoluble** in water.
9. For the third substance (name) state the **type of solid** that it is	**$Cu_{(s)}$ copper is a metallic solid.**
10. describe the **structure** of this type of substance using the *terms* above in the table	**$Cu_{(s)}$ is** made up of an array of atoms (or ions) held together by non-directional forces between the positive nuclei of the atoms and the delocalised / free moving valence electrons.
11. explain how the **bonding** relates to the attraction between particles in your substance and water particles	There is no attraction between the copper atoms and the (polar) water molecules,
12. link to the **observation** (solubility) in your question for the third substance	therefore Cu is **insoluble in water**.

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.