Worksheet 2.2: Solutions

Explanation of properties

No.	Answer
1	NaBr has the higher melting point. NaBr is an ionic solid with strong ionic bonds between the positive and negative ions in the ionic lattice. HBr is a covalent molecular compound and even though it has strong covalent bonds between the H and Br atoms within each molecule, it is only the weak bonding (dipole–dipole forces) between these neutral molecules that is disrupted in the melting process. The weak intermolecular bonding requires less heat to disrupt than the strong ionic bonds.
2	**a** An aqueous solution is one in which the sodium chloride crystals are dissolved in water and so dissociate from one another. Liquid sodium chloride occurs when the substance is heated sufficiently for it to melt and turn it into a liquid. **b** Both an aqueous solution of NaCl and liquid NaCl are good conductors of electricity because they contain ions that are free to move under the influence of an electric field.
3	Both graphite and diamond are classified as covalent network substances. However, in diamond the strong covalent bonds are between the carbon atoms in a three-dimensional lattice whereas ion graphite these covalent bonds are between the carbon atoms in a two-dimensional layer lattice. Between the layers of covalently bonded carbon atoms in graphite are weak (dispersion) forces, and as a result the layers can easily slip over one another. Diamond is a very hard material and can scratch glass. When graphite is rubbed on the glass, layers of this black material rub off onto the glass surface.
4	The ionic bonding in KF is very strong and so requires a great deal of energy to be overcome. The positive and negative ions are held together in the lattice by strong electrostatic attractions. The metallic bonding in potassium is relatively weak and the intermolecular bonds (dispersion forces) between fluorine molecules are very weak, resulting in lower melting points.
5	Because brass is a metal, it is made of a lattice of positive ions surrounded by delocalised electrons. When a piece of brass is hit, the layers of positive ions are able to move over one another, and because the delocalised electrons remain between these ions, the metallic bonding (the attraction between the positive ions and the delocalised electrons) still exists. The piece of brass therefore does not break apart. However, copper sulfate is composed of a lattice of positive and negative ions. When one layer of ions is pushed over an adjacent layer, positive ions will come close to one another and repel one another, as will negative ions. This will cause the ionic lattice to shatter.
6	White phosphorus is a covalent molecular element composed of neutral P_4 molecules. Because the electrons of involved in the bonding within these molecules, there are no ‘free’ charged particles to act as charge carriers for the conduction of electricity. Bismuth, however, is a metallic element. It is composed of a lattice of positive ions surrounded by delocalised electrons. These electrons are able to conduct electricity.

7	Silicon dioxide is a covalent network compound. The covalent bonds hold the atoms in a three-dimensional lattice. To melt this compound, it is necessary to break these covalent bonds, which requires a large amount of heat energy. Sodium carbonate is an ionic compound, composed of positive Na^+ ions and negative CO_3^{2-} ions. When this compound melts, the ionic bonds are disrupted, not the covalent bonds between the C and O in the carbonate ions. Ionic bonds are strong and as a result a significant amount of heat energy is required to disrupt them. Water is a covalent molecular compound. When water (ice) is melted, only the weak intermolecular bonds between the molecules are broken (not the covalent bonds between the H and O atoms).
8	**a** Delocalised electrons **b** Delocalised electrons and positive mercury ions **c** K^+ and NO_3^- ions **d** H^+ ions (or H_3O^+ ions) and Cl^- ions **e** Na^+ and NO_3^- ions **f** Delocalised electrons between the layers **g** Delocalised electrons