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1. Salt did not have an odor, while naphthalene did. This is because salt is an ionic compound, and the bonds between its ions are very strong, while naphthalene’s molecules are only connected by weak London dispersion. Thus, since the attractive forces in naphthalene were much weaker than those in salt, naphthalene was able to give off a strong odor while salt was not.
2. Volatility describes how easily a substance vaporizes. Odor and volatility are related because a volatile substance is much more likely to give off a strong odor.
3. Ethanol and hexane both had odor while water did not. Water was also not volatile, while ethanol and hexane were both volatile and evaporated quickly. This is because water has two strong hydrogen bonds in each of its molecules, so it has much stronger IMF than the other two and is less likely to vaporize or give off odor. None of the three liquids were particularly viscous. For a liquid to be very viscous, the IMF still has to be stronger than that in water, ethanol, or hexane.
4. Electrons in ionic crystals are mobile and free to move throughout the crystal under the influence of applied voltage. This can be seen when salt conducted electricity when dissolved in ethanol and water.
5. Yes, ionic crystals can form ionic solutions. Salt, an ionic compound, dissolved in both ethanol and water to form ionic solutions. This happens because of entropy and the attraction between ions and water molecules. Even though it takes energy to break ionic bonds, the ions are very attracted to the water molecules and the attractions between them can cause a release of energy. Paired with the fact that entropy says that matter wishes to be more and more disorderly, ionic compounds dissolve in water because it involves little energy change and satisfies entropy by causing more disorder.
6. Yes, I would expect a melted ionic crystal to conduct electricity. An ionic crystal conducted electricity when it was dissolved in ethanol and water, suggesting that ionic compounds will conduct when the ions are free to move, like they are when they are dissolved. This means that, when melted, an ionic compound will likely conduct electricity since its ions/charged particles are free to move.
7. Crystals of nonpolar molecules form molecular solutions. Iodine, naphthalene, and para-dichlorobenzene are all molecular and nonpolar and formed solutions. While salt formed solutions and is ionic, it cannot be said to be nonpolar, since it conducted electricity when dissolved, signifying that it had charged particles in it. Therefore, salt is not nonpolar because it contains charged particles.
8. Solids with polar bonds, like glucose and para-dichlorobenzene, were more difficult to break, and network covalent solids, like sand, were very hard. This is because their bonds are very strong and hold the molecules together. Ionic solids like salt were also pretty hard due to their bond strength. Lastly, the copper bent but did not break because the structure of a sea of electrons amongst metal ions makes copper’s structure strong but not rigid. Thus, copper will not break easily, but will bend.
9. The intramolecular forces are greater in naphthalene because they are covalent bonds and not the weak London dispersion that is there as the IMF. The IMF is evidently weak, since the melting point is low, the solid is easy to break, and the substance gives off a strong odor. The intramolecular forces are much stronger than the IMF, as seen by the low melting point, which signifies that it does not take much energy to break the IMF, while the intramolecular forces still remain intact after melting.
10. No, not all molecular substances with polar bonds are polar. For example, para-dichlorobenzene has two polar C-Cl bonds. However, the substance itself is not polar because the two bonds pull in opposite directions and cancel each other out, as proven by the fact that para-dichlorobenzene does not dissolve in polar solvents. This means that para-dichlorobenzene has no attraction to the molecules of polar solvents, showing that its molecules have no charge on them and are not polar.
11. Glucose has the highest melting point because its hydrogen bonds cause the IMF to be very strong and make the melting point very high. The second highest melting point is that of iodine, because its very high mass causes the London dispersion to be extremely strong, making the melting point pretty high. Lastly, naphthalene has a higher melting point than para-dichlorobenzene due to its shape. Since naphthalene is less compact, it is easier for its molecules to get closer together, making the IMF stronger and the melting point higher.
12. All four molecular substances had low melting points, with their melting points being <150°C, while non-molecular substances’ melting points were all >800°C. None of the four molecular substances conducted electricity, whether solid or dissolved. Therefore, a molecule is molecular if it melting point is fairly low compared to non-molecular substances’ melting points and if it does not conduct.
13. NaCl Ionic

C6H12O6 Molecular

Cu Metallic

I2 Molecular

SiO2 Network Covalent

C10H8 Molecular

*p-*C6H4Cl2 Molecular

1. Iodine creates a brown solution when dissolved in water or alcohol and creates a purple solution when dissolved in hexane. This is because iodine molecules are separated by hexane molecules when it is dissolved in hexane, but when iodine is dissolved in water or alcohol, an ion is formed in a chemical change that causes an equilibrium in the solution.
2. In order for an ionic compound to dissolve, the ionic bonds must be broken in a highly endothermic and unfavorable process. However, ions are attracted to water molecules in an exothermic process. If the net change is not too endothermic, then entropy (which says that matter wishes to be more disordered) will cause the ionic compound to dissolve. Otherwise, the compound will not dissolve. For this reason, depending on how endothermic the net change is, an ionic compound may or may not be very soluble in water.
3. To dissolve nonpolar molecular substances in hexane, you have to break the London dispersion between the molecules of molecular substance. Depending on how much mass the molecular substance has, the London dispersion may be weak or strong. If the London dispersion is too strong and takes too much energy to break, the substance will not dissolve in hexane. Therefore, there would be a wide range in the solubility of nonpolar molecular substances in hexane.

**Table 2**

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| --- | --- | --- | --- |
| **Chemical** | **Structure** | **Type of Bonding and Polarity** | **Type(s) of IMF** |
| NaCl |  | Ionic bonds  Not polar (has ions) | Ionic bonds/  attractions |
| *n*-C6H14 |  | Covalent bonds  Nonpolar | London dispersion |
| SiO2 |  | Covalent bonds  Nonpolar (bonds are polar but symmetry cancels it out) | Covalent bonds/  attractions |
| C10H8 |  | Covalent bonds  Nonpolar | London dispersion |
| *para-*C6H4Cl2 |  | Covalent bonds  Nonpolar (bonds are polar but symmetry cancels it out) | London dispersion |
| H2O |  | Covalent bonds  Polar | Hydrogen bonding, London dispersion |
| C2H5OH |  | Covalent bonds  Polar | Hydrogen bonding, London dispersion |
| C6H12O6 |  | Covalent bonds  Polar | Hydrogen bonding, London dispersion |