HPS Ionic vs Covalent Compounds Virtual Lab KEY 2021 Name:

**Objective 6:** Compare and contrast the physical & chemical properties of ionic and covalent compounds.

**Introduction**

Chemical compounds can be separated into two major categories:  ionic compounds and covalent compounds.  The properties of these compounds are summarized in the table below.

|  |  |
| --- | --- |
| Ionic Compounds | Covalent Compounds |
| Made of a metal and a nonmetal | Made of a nonmetal and a nonmetal |
| One atom takes electrons, one loses | Atoms share electrons |
| Higher melting and boiling points | Lower melting and boiling points |
| Generally solids at room temperature | Often liquids and gases at room temp |
| Usually hard/brittle | Often softer |
| Conduct electricity (electrolytes) | Do not conduct electricity |
| Dissolve readily in water | Do not dissolve readily in water |

**Purpose:** To determine whether a given list of substances are ionic or covalent compounds.

**Procedure:** While you watch the [video](https://live.myvrspot.com/iframe?v=fNjFhMGM5MTQ3NTU1N2I3YzcwMjhmYjhmNmZkZDE2NzI), there are four properties listed below that should be observed (read through them carefully before watching the video), record your observations in the space provided below. You will be asked to complete an organized data table, so keep things detailed, clear, and organized.

**4 properties:**

**A)** Physical Appearance - color, texture, physical state of solid, liquid, or gas. (~:10-1:30)

**B)** Solubility in room temperature water. Water is a very polar molecule—it has both partial (+) and partial (-) charge. If the substance disappears when mixed with the water, that means it has dissolved. (~1:30-4:10)

**C)** Ability to conduct electricity when mixed with water, using a light bulb. Record not just whether the bulb lights up but how bright, such as using none, +, ++, or +++ for amount of brightness (~4:10-7:30)

**D)** Melting time: given the same amount of heat, which compounds have a LOW melting point (melting time is relatively quick), or a HIGH melting point (melting time is relatively high or does not melt at all). NOTE that for melting time, YOU will time the melting, starting at zero when the flame is put under the substance, to when the substance begins to melt. Record this melting time. (~7:30-

**Data**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Compound | Physical Appearance  (color, texture, state of matter) | Solubility test (how easily substance dissolved) | Conductivity test  (+, ++, +++) | Melting point test (time it took for substance to melt) | Ionic or Covalent |
| Potassium iodide  KI | Solid, white, fine | Dissolves | +++ | 1:19  High MP | IONIC |
| Potassium Chloride  KCl | Solid, white, fine | Dissolves | +++ | After 1:30, no melting  High MP | IONIC |
| Glucose  C6H12O6 | Solid, white, fine pieces | Dissolves | none | :12  Low MP | COVALENT |
| Potassium nitrate KNO3 | Solid, white, coarse/spheres | Dissolves | +++ | :29  Low MP | IONIC |
| Paradichlorobenzene (PDCB) C6H4Cl2 | Solid, clear/white | Not dissolve | none | :04  Low MP | COVALENT |
| Benzoic acid C6H5COOH | Solid, white | Not dissolve | none | :09  Low MP | COVALENT |
| Acetic acid CH3COOH | Liquid, clear | Dissolves | + | NA – liquid at room temp  Very Low MP | COVALENT |
| Paraffin wax C24H50 | Solid, clear | Not dissolve | none | :07  Low MP | COVALENT |
| Hydrogen chloride HCl (aq) | Gas, invisible | Dissolves | +++ | NA – gas at room temp  Extremely Low MP | POLAR COVALENT |

**Analysis**

1. What does the fact that acetic acid is a liquid, and HCl is a gas, tell you about their melting points compared to the solids tested?

Because acetic acid is liquid at room temperature, its MP is likely very low (61.88 \*F) Because HCl is gaseous at room temperature, its MP is likely extremely low. (-173.6 \*F)

2. Is there any one property that best indicates whether a compound is ionic or covalent? Explain your reasoning.

It seems like melting point would best indicate whether a compound is ionic or covalent. There is only 1 discrepancy, and that is potassium nitrate. The interesting thing here is that the NO3 is a polyatomic ion (two or more atoms covalently bonded together with an overall net charge). This would explain its low MP, even though the bond between the potassium ion and the nitrate ion form an ionic bond.

3. Are ionic and covalent compounds always different in every way described in the data table? Give examples from your lab.

No. HCl is bonded covalently, but it dissolves in water. The explanation for this is that it is polar (has a partial positive end and a partial negative end). It dissolves in water, because water is polar as well (like dissolves like). The polarity of HCl also explains its ability to conduct electricity. Glucose is not soft, liquid or gas at room temperature, and it dissolves (eventually) in water. These characteristics are not consistent with the normal properties of a covalent compound.

4. What do you imagine are some uses for ionic compounds? What would be some uses for covalent compounds?

I – fireworks (can withstand high temperatures), electrolytes (can dissolve in water and help give our body the ions needed), paint pigments, bath bombs (sodium bicarbonate – NaHCO3)  
C – insulator (cover wires), plastic/rubber (bath tub toys)