**Lab Investigation: Properties of Ionic, Covalent and Metallic Bonds**

**Introduction**

* The purpose of this lab is to classify several house-hold substances according to bond type: ionic, covalent and metallic.
* Several properties will be examined including: solubility in water, melting point, electrical conductivity, malleability and hardness, and physical appearance.

**Introduction Question (please include these answers in your introduction paragraph)**

* Discuss the difference between ionic, covalent and metallic bonds at a fundamental level. Based on what we know about the structure of these bonds, what properties would you expect to see in ionic vs. covalent vs. metallic bonds?
* What are other types of bonds that may influence these properties?
* In the following Table, predict which bond types will correspond to each substance or solution:

|  |  |  |
| --- | --- | --- |
| Common or IUPAC Name | Chemical Formula or Structure | Predicted Type(s) of Bonding |
| Cocoa powder (contains cocoa and sodium carbonate)  | C7H8N4O2 and Na2CO3 |  |
| Parowax (petroleum wax)  | CnH2n+2 (high molecular weight alkanes)  |  |
| Stevia (artificial sweetener)  | C20H30O3 (and others)  |  |
| Table salt (sodium chloride)  | NaCl |  |
| Baking soda (sodium bicarbonate)  | NaHCO3 |  |
| Washing soda (sodium carbonate) | Na2CO3 |  |
| Graphite  | C |  |
| Aluminum foil  | Al (with some oxides and other metals present)  |  |
| Copper Penny (pre 1996) | >95% Cu, with Sn and Zn  |  |
| Isopropyl alcohol | C3H8O |  |

**Procedure**

Lab station 1: Electrical conductivity (10 minute station)

1. **If the substance is a powder**: In a 100 mL beaker, dissolve 1 gram of substance into 50 mL of distilled water. Test conductivity with a conductivity meter. Record your observations.
2. **If the substance is not a powder**: Place the conductivity probes directly on the substance and measure. Record your observations.

Lab station 2: Solubility in water (10 minute station)

1. Test the solubility of each compound by putting a small amount in a test tube, adding ½ of test tube of water, stoppering, and shaking hard for 30 seconds to see if it will dissolve. Record your observations.

Lab station 3: Malleability & Hardness (10 minute station)

1. Attempt to bend your sample. If you can bend it, it is malleable.
2. Take a small amount of the substance and attempt to crush it between two index cards. If the substance remains the same, it is hard.

NOTE: Do not complete this test if your substance is in liquid form.

Lab station 4: Melting point (10 minute station)

1. Turn on the hot plate to lowest setting. Place a square of aluminum foil on the hot plate. Put a tiny amount of each substance on the foil (one drop for a liquid and an equivalent size for solids).
2. Observe which substances melt. After 5 minutes, turn off hot plate and record data.

Lab Station 5: Physical appearance (10 minutes)

1. Record general observations about the substances/solutions, including colour, odor and state at room temperature (gas, liquid or solid). Use a magnifying glass, if necessary.

**Data Collection**

**Table 1: Investigation of physical properties of ten compounds.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Substance or solution | Electrical conductivity | Solubility in water | Malleability and hardness | Melting point | Colour | State at room temperature |
| Cocoa powder (contains cocoa and sodium carbonate)  |  |  |  |  |  |  |
| Parowax (petroleum wax)  |  |  |  |  |  |  |
| Stevia (artificial sweetener)  |  |  |  |  |  |  |
| Table salt (sodium chloride)  |  |  |  |  |  |  |
| Baking soda (sodium bicarbonate)  |  |  |  |  |  |  |
| Washing soda (sodium carbonate) |  |  |  |  |  |  |
| Graphite  |  |  |  |  |  |  |
| Aluminum foil  |  |  |  |  |  |  |
| Copper Penny (pre 1996) |  |  |  |  |  |  |
| Isopropyl alcohol |  |  |  |  |  |  |

**Physical Properties of Ionic, Covalent, and Metallic Bonds**

**Chemistry 11-2**

**Student Name**

**7 November 2019**

**Introduction**

The purpose of this lab was to classify several house-hold substances according to bond type: ionic, covalent and metallic. To distinguish between the bonds, several properties were examined including solubility in water, melting point, electrical conductivity, malleability and hardness.

*PLEASE ANSWER INTRODUCTION QUESTIONS HERE…*

**Results & Discussion**

*PLEASE INCLUDE THE FOLLOWING (IN PARAGRAPH FORM!):*

* *Briefly summarize results. In your opinion, which substances or solutions were examples of ionic bonding, metallic bonding and covalent bonding? Defend your opinion with evidence from Table 1.*
* *Are there other types of bonding happening in this lab that are influencing the results? Discuss. Please find one source to support your results.*
* *Discuss potential sources of error in this experiment. Also discuss how you might improve this lab if you did it another time.*

**References**

* *Please include at least one credible reference here, cited MLA style.*

**Appendix**  (*PLEASE INCLUDE TABLE 1 – YOU* DO NOT *NEED TO RE-WRITE IT)*

*RUBRIC*

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria**  | **Novice / N+****(40-59)**  | **Apprentice / Apprentice +****(60-79)** | **Journeyman / Virtuoso (80-100)** |
| **Presentation**  | Poorly organized, uses informal language and does not follow template |  | Follows template somewhat, may use “I” or “we” in text and is somewhat disorganized. There may be significant mistakes in grammar.  |  | Follows template provided (font, font size, etc.), never uses “I” or “we” in text and is extremely well- organized and concise! Well-written. |
| **Content Knowledge**  | Lack of content knowledge / weak introduction and discussion |  | Introduction and discussion may contain some inaccurate information. The majority shows understanding. |  | Introduction and discussion show deep understanding of bonding theory. Demonstrates the ability to think at a higher level.  |
| **Use of Evidence**  | Lacks evidence to back up claims |  | Uses some evidence to back up claims (either table or external reference). Reference may not be credible. |  | Evidence is convincing and relevant. A credible reference is used to support findings.  |