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| **Dougherty Valley HS AP Chemistry** | **Name:** | |
| **“What’s in That Bottle?” Bonding in Solids Lab** | **Date:** | |
| **Group Name / Data Set #:** | **Period:** |  |

**Pre-Lab Guiding Questions/Simulations**

Using the chart on p. 53 from the lab protocol, answer the PRE-LAB questions #1-2 from the top of page 54 on the lab protocol. (Note: #2 is modified from the lab protocol and contains different substances.)

1. Compare the type of bond with regard to the properties below using Table 1 and explain any relationships.
   1. Melting point:
   2. Solubility in 25℃ water:

2. Predict the properties of each substance below based on Table 1.

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| **Compounds** | **Bond Type** | **Relative Melting Point** | **Solubility in Water** |
| Iodine chloride (ICl) |  |  |  |
| Cobalt(II) nitrate (Co(NO3)2) |  |  |  |
| Lead (Pb) |  |  |  |
| Sulfur (S8) |  |  |  |

**Practice with Instrumentation and Procedure**

Using the lab video, fill in this T-table with the chemistry teacher’s experimental procedure in the left column and any corresponding qualitative observations and/or quantitative data in the right column for the four unknowns she used. Use your own words when summarizing or paraphrasing the procedure. Format the table as you see appropriate.

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| **Procedure** | **Data/Observations** |
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
|  |  |
|  |  |
|  |  |
| (add more rows as needed) |  |

**Practice Questions (from p. 56, #1, 3, and 4 only - skip #2):**

1. Based on the Practice Instrumentation and Procedure data, list the general properties associated with each bond type (metallic, ionic, polar covalent, nonpolar covalent).

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1. Skip this question.
2. How can your experimental procedure be improved? List what your team/group would do differently. If any additional materials are needed, please inform the teacher.

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1. Design a flowchart using experiment procedure that can help you identify unknown compounds.

A hand drawn flowchart must be used to answer this question. Pics **MUST** have the **FULL NAME of the person working on that part** in the image in **INK** or your calculations will not receive any credit. Insert into corresponding areas below:

|  |
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| [Insert pics here] |

**Investigation**

See directions from p. 56-57 about the procedure first. Tailor and fill in this T-table using the corresponding steps from the chemistry teacher’s experimental procedure from the video in the left column and any corresponding qualitative observations and/or quantitative data in the right column for the unknowns from the data provided for your group. The data given will exceed the minimum of 4 tests (as stated in the lab protocol). Use all of the data given for your group. Use your own words when summarizing or paraphrasing the procedure. Format the table as you see appropriate.

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| --- | --- |
| **Procedure** | **Data/Observations** |
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
|  |  |
|  |  |
|  |  |
| (add more rows as needed) |  |

**Test for Properties of Unknown Solids Data Table:**

Organize and fill in the data given.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| Unknown 1 |  |  |  |  |  |  |
| Unknown 2 |  |  |  |  |  |  |
| Unknown 3 |  |  |  |  |  |  |
| Unknown 4 |  |  |  |  |  |  |
| Unknown 5 |  |  |  |  |  |  |
| Unknown 6 |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | **Bond Type** |
| Unknown 1 |  |  |  |  |  |  |
| Unknown 2 |  |  |  |  |  |  |
| Unknown 3 |  |  |  |  |  |  |
| Unknown 4 |  |  |  |  |  |  |
| Unknown 5 |  |  |  |  |  |  |
| Unknown 6 |  |  |  |  |  |  |

**Data Collection and Computation:**

The list of unknown solids is in the chart at the top of p. 55. Identify each unknown. Justify your answers by citing your data for the bonding type and identification of your unknown solids.

|  |  |
| --- | --- |
| **Unknown samples** | **Justify** |
| **Unknown #1 =** |  |
| **Unknown #2 =** |  |
| **Unknown #3 =** |  |
| **Unknown #4 =** |  |
| **Unknown #5 =** |  |
| **Unknown #6 =** |  |

**Argumentation and Documentation (from p. 57 in the lab protocol):**

1. To what extent do you believe the classification of your unknown is reliable? Justify your claim with evidence.

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1. Discuss in your group the two most significant tests done to identify each of the types of bonds

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1. Skip this question.
2. Obtain (Google search) MSDS of your substances to summarize the toxicity and method of disposal for each of your “unlabeled bottles.”
   1. Unknown 1 (xxxxxxx):
   2. Unknown 2 (xxxxxxx):
   3. Unknown 3 (xxxxxxx):
   4. Unknown 4 (xxxxxxx):
   5. Unknown 5 (xxxxxxx):
   6. Unknown 6 (xxxxxxx):

**Post-Lab Assessment**

Calculations may be typed or handwritten for this lab. Type calculations or Insert picture(s) of your POST-LAB calculations from Parts 1, 2, and 3 as stated on pages 61 and 62 on the lab protocol. If handwritten, pics **MUST** have the **FULL NAME of the person working on that part** in the image in **INK** or your calculations will not receive any credit. Insert into corresponding areas below:

\*To be completed after the experiment in this google doc (The questions are the same as the post-lab assessment questions on page 57 in the lab protocol plus a few more).

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| **Discussion Questions [handwritten, insert image on to the next page of this doc** |
| 1. How do the melting points of ionic compounds compare to those of covalent compounds? What evidence from the investigation supports your conclusion? |
| 2. When the solids were placed in water were all the results the same? What types of solids conduct electricity in water? Use your investigations to explain what happened. |
| 3. Explain how you were able to determine each unknown as being an ionic, metallic, or covalent (polar or nonpolar) compound. |
| 4. If the solid is ionic, explain why you cannot make the general statement that “all ionic compounds are soluble in water.” What evidence from the investigation supports your conclusions? |
| 5. Why was it necessary to use distilled water and not tap water? |
| 6. Metal oxides dissolved in water show a pH in what range? In contrast to these metal oxides, do nonmetal oxides produce the same pH range? |
| 7. Wax is a saturated hydrocarbon, a covalent compound. Wax is not soluble in water yet sugar is a covalent compound and is soluble in water. Look at the structure of both compounds and explain what could justify these results. |
| 8. To convert the following compounds from a solid to a liquid, what types of intermolecular forces must be overcome?  a. I2(*s*) → I2(*l*)  b. H2O(*s*) → H2O(*l*)  c. NaI(*s*) → NaI(*l*)  d. C16H32(*s*) → NaI(*l*) |
| 9. In order for a substance to conduct electricity, it must have free-moving charged particles.  a. Explain the conductivity results observed for ionic compounds in the solid state and in aqueous solution.  b. Would you expect molten sodium chloride to conduct electricity? Why or why not? |