**Experiment 4: Qualitative Analysis of a Solid and Liquid Unknown**

**Preface:** In Experiment 4, a series of chemical tests was utilized in an effort to better elucidate structural and functional properties of a solid and liquid unknown, respectively. While “chemical construction” will be performed with NMR and IR spectra interpretation for Experiment 5, use the results of this lab to consolidate your future direction and speculate on the possible chemical identity of your unknowns.

*You will NOT be graded on the accuracy of your unknown identification until Experiment 5*. Instead, you will be graded on the quality of your responses and the logic of your hypothesis.

**\*\*\*\*This assignment may be worked on with your partner, with one lab report per partner pair.** NMR and IR will, however, be an **individual assignment** so please make sure you make copies of the spectra given to you in class to the partner who does not have it.\*\*\*\*\*

**Unknown Solid #:**

**Unknown Liquid #:**

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| **Part 1 – Melting Point/Boiling Point Determination** | |
| **a. Melting Point—Solid Unknown** | |
| What was the melting point range of your solid unknown? |  |
| Based on the melting point, speculate on which intermolecular forces your unknown may engage in. |  |
| **b. Boiling Point—Liquid Unknown** | |
| What was the boiling point of your liquid unknown? |  |
| Based on the boiling point, speculate on which intermolecular forces your unknown may engage in and its spatial structure (i.e. branched, linear). |  |

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| **Part 2 – Solubility Tests** | |
| **a. Solubility indications—Solid Unknown** | |
| What did you observe for the solubility of your unknown in **ethyl acetate?** |  |
| What did you observe for the solubility of your unknown in **5% HCl?** |  |
| What did you observe for the solubility of your unknown in **5% NaOH?** |  |
| What did you observe for the solubility of your unknown in **5% NaHCO3?** |  |
| What did you observe for the solubility of your unknown in **H2SO4?** |  |
| From the culmination of the above results, **what kind of compound is your solid unknown?** What are its likely functional groups? *(Use the solubility chart as a good reference, here) 3-4 sentences* |  |

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| **Part 2 – Solubility Tests** | |
| **a. Solubility indications—Liquid Unknown** | |
| What did you observe for the solubility of your unknown in **ethyl acetate?** |  |
| What did you observe for the solubility of your unknown in **5% HCl?** |  |
| What did you observe for the solubility of your unknown in **5% NaOH?** |  |
| What did you observe for the solubility of your unknown in **5% NaHCO3?** |  |
| What did you observe for the solubility of your unknown in **H2SO4?** |  |
| From the culmination of the above results, **what kind of compound is your solid unknown?** What are its likely functional groups? *(Use the solubility chart as a good reference, here). 3-4 sentences* |  |

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| **Part 3: Beilstein Test** | |
| **Theory:** What does the Beilstein test assess the production of? What is a positive qualitative result? A negative qualitative result? (2-3 sentences) |  |
| **a. Solid unknown Beilstein result** | |
| Color of flame? Indication? |  |
| **a. Liquid unknown Beilstein result** | |
| Color of flame? Indication? |  |

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| **Part 4 Chemical Classification Tests** | |
| **Test 1: 2,4-Dintrophenylhyrdazine (Brady’s Reagent)** | |
| **Theory:** What does Brady’s reagent test for? What is the indication for a positive result? Negative result? Describe the reaction, in brief. (3-5 sentences) |  |
| **a. Solid Unknown result** | |
| Color of precipitate? Indication? |  |
| **a. Liquid Unknown result** | |
| Color of precipitate? Indication? |  |

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| **Part 4: Chemical Classification Tests** | |
| **Test 2: Ferric Chloride test** | |
| **Theory:** What does the Ferric Chloride test assess? What is the indication for a positive result? Negative result? Describe the reaction, in brief. (3-5 sentences) |  |
| **a. Solid Unknown result** | |
| Color of precipitate? Indication? |  |
| **a. Liquid Unknown result** | |
| Color of precipitate? Indication? |  |

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| **Part 4: Chemical Classification Tests** | |
| **Test 3: Hydroxamic Acid Test** | |
| **Theory:** What does the Hydroxamic test assess? What is the indication for a positive result? Negative result? Describe the reaction, in brief. (3-5 sentences) |  |
| **a. Solid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |
| **a. Liquid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |

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| **Part 4: Chemical Classification Tests** | |
| **Test 4:Hinsberg Test** | |
| **Theory:** What does the Hinsberg test assess? What is the indication for a positive result? Negative result? Describe the reaction, in brief. (3-5 sentences) |  |
| **a. Solid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |
| **a. Liquid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |

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| **Part 4: Chemical Classification Tests** | |
| **Test 5: Sodium Bicarbonate Test** | |
| **Theory:** What does the sodium bicarbonate test assess? What is the indication for a positive result? Negative result? |  |
| **a. Solid Unknown result** | |
| CO2 production? Indication? |  |
| **a. Liquid Unknown result** | |
| CO2 production? Indication? |  |

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| **Part 4: Chemical Classification Tests** | |
| **Test 6: Lucas Test** | |
| **Theory:** What does Lucas Reagent test for? What is the indication for a positive result? Negative result? Describe the reaction, in brief. (3-5 sentences) |  |
| **a. Solid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |
| **a. Liquid Unknown result** | |
| Color of precipitate (if formed)? Indication? |  |

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| **Summary and Speculative Solid Unknown Identity** |
| **In 4-8 Sentences,** describe what the results of the test above indicate about the functional groups and properties of your unknown. Feel free to include information on crystal color and shape in this discussion. Finally, suggest a type of chemical compound and the putative identity based on logical induction |
| Summary: |
| **Draw a possible structure of your solid unknown:** |

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| **Summary and Speculative Liquid Unknown identity** |
| **In 4-8 Sentences,** describe what the results of the test above indicate about the functional groups and properties of your unknown. Feel free to include information on your unknown liquids color, opacity and smell (with wafting). Finally, suggest a type of chemical compound and the putative identity based on logical induction |
| Summary: |
| **Draw a possible structure of your Liquid unknown:** |