Purity and purifications of solids using melting points.

Values of melting points obtained in the observation were recorded in Table 1 and plotted into Graph 1. Identification of an Unknown using Mixture Melting Points. MP of unknown H was determined using procedure indicated on p. 43-45 in FFF. Two known samples with the closest to unknown H mps were determined. Two mixtures were prepared, each combining unknown with the known sample in 50/50 proportion. MP of each mixture was observed and recorded. Mixture that had sharp melting point was mixture that contained identical parts. Results and discussion

Melting points for mixtures containing different percent of Naphthalene to Biphenyl were observed, recorded, averaged and graphed in Table 1 and Graph 1. Average was taken from several results obtained by organic chemistry lab. Table 1. Average melting point specific to % Naphthalene in Naphthalene-Biphenyl mixture % Naphthalene inNaphthalene-Biphenyl mixture (%)| Corresponding Melting point (°C)| 0| 68. 09| 10| 62. 36| 30| 53. 88| 50| 47. 74| 70| 50. 99| 90| 73. 55| 100| 78. 87| Mole Percent of Naphthalene Temperature (C) Graph 1. Melting Point Diagram for Naphthalene and Biphenyl.

Observed melting points of pure Naphthalene and Biphenyl (in Table 1) are consistent with CRC Handbook1, that indicates melting temperatures for these substances at 80. 2°C and 71. 0 °C, respectively. Based on the graph above eutectic point lies at 50% mole percent Naphthalene. Class results were averaged, therefore one inaccurate result would effect the average point, this could be a potential source of error in the experiment. However, class average for MP of pure substances came close to values in CRC Handbook. Another Source of error is limited data points that were observed.

Best fitted line illustrated in Table 1 can contain a source of error due to the insufficient number of data points. Using Melting point technique unknown H, was determined to have MP in the range from 73. 3 to 75. 4. Based on its melting point it was mixed with 3-Ethoxy-4-hydroxybenzaldehyde and pure Biphenyl. Results are reported in Table 2. Substance tested| Melting Point (°C)| Unknown H/3-Ethoxy-4-hydroxybenzaldehyde| 76. 1 – 78. 7| Unknown H/ pure Biphenyl| 55. 0 – 59. 6| Table 2. Melting points of mixtures containing unknown H in 50/50 proportion.

Based on the fact that mixture with 3-Ethoxy-4-hydroxybenzaldehyde had relatively close range of (76. 1 °C – 78. 1 °C) with 2. 5 °C difference in ending values, which can be considered as a sharp point, unknown H is 3-Ethoxy-4-hydroxybenzaldehyde. Conclusion Melting point is a technique used to identify pure substances by observing ranges of melting points as it was done in mixtures of Naphthalene and Biphenyl. Eutectic point, however, should be kept in my when testing for pure substances, for eutectic compositions can mislead results of the test if nothing else is considered.

Biphenyl’s on this technique unknown H tested was determined to be 3-Ethoxy-4-hydroxybenzaldehyde based on its sharp MT. Questions: 1. a) Examples in which a pure substance could give a broad melting range: 5 mole percent of Naphthalene to 95 mole percent of Biphenyl (which is good percentage of purity) has a broad melting range. b) Example of a situation in which an impure substance melts sharply: Mixture of 60 mole percent of Naphthalene and 40 mole percent of Biphenyl. Mixture has eutectic composition. 2.

Eutectic mixture – mixture in which proportions of its constituents allow a uniform melting point for that mixture. MP range is sharp, despite the fact that mixture is impure. 3. Effects of the impurities on melting behavior of benzoic acid: MP Benzoic Acid – 122 °C a. Fragments of crushed glass – MP of crashed glass is around 1500 °C, which is a lot higher than MP of B. A. Due to the big difference in melting points between substances, glass will stay insolvent. MP of B.. A. will not change, it will melt with pieces of glass in the substance. . Residual recrystallization solvent –mostly contains water, which would lower the melting point of B. A. c. Filter paper fibers – MP of B. A. will not change, due to large differences in Mps. Fibers will remain in the melted B. A. d. Particles of ceiling plaster that fell into the sample – MP of B. A. will not change due to difference in Mps. 4. FFF, 2. 8, p. 48: Suppose you are taking a MP and compound disappears.. What happened? Compound was a volatile compound that changes from solid to gaseous form without going through liquid form (sublimed).

To prevent this one end of the capillary should be sealed. 5. Because compound is in clusters, it takes more heat to go through layers to heat up a compound. However, more heat doesn’t mean higher melting point. It has more substance to heat. 6. Even if two compounds have the same melting point, if they are not identical MT of their mixture will be depressed. Therefore, mixture that shows the same MT as an unknown would identification. References 1CRC Handbook, CRC Press: New York, 1999.