

Crystallization Post-Lab Explanation

Question 1: **NOTE: If you did not recrystallize phthalic acid, do below (part a through part d) for benzoic acid. Assume benzoic acid has the same solubility as phthalic acid at those 2 temperatures (even though it really doesn't)! If you didn't recrystallize phthalic acid or benzoic acid, do below (part a through part d) for salicylic acid.**

- The solubility of phthalic acid in 100 mL of water is given in *The Handbook of Chemistry and Physics* as 0.54 g at 14 °C and 18 g at 99 °C.
 - What volume of water was theoretically required to dissolve your phthalic acid?

Theoretical volume of water required to dissolve Phthalic Acid:

Mass of Phthalic Acid weighed out = say you weigh 0.200 g (you use what you weighed here!)

Dissolution at 99°C (boiling H₂O)

$$18\text{g}/100\text{mL} = 0.200\text{g} / X \text{ mL}$$

$$X \text{ mL} = 0.200\text{g} \times (100 \text{ mL}/18\text{g}) = \mathbf{1.11 \text{ mL}}$$

- How much phthalic acid should you have theoretically recovered (you may assume that ice-bath temperature is 14 °C)?

Mass of Phthalic Acid recovered at 14°C (ice bath temperature):

$$0.54\text{g}/100\text{mL} = X \text{ g}/1.11\text{mL}$$

$$X \text{ g} = (0.54\text{g}/100\text{mL}) \times 1.11\text{mL} = 0.0060 \text{ g (mass still in solution at 14°C)}$$

$$\text{Recovery assuming 100\% yield} = 0.200\text{g} - 0.006\text{g} = \mathbf{0.194 \text{ g}}$$

- Calculate the % difference for the volume.

$$\% \text{ Difference for the volume} = (\text{volume used}/1.11\text{mL}) \times 100\% = ???$$

Volume used is the volume you measured!

- Calculate the % difference for the recovered mass.

$$\% \text{ Difference in the recovered mass} = (\text{recovered mass}/0.194\text{g}) \times 100\% = ???$$

Recovered mass is the mass you recovered

Question 2: Determine the solubility of benzoic acid at 99 °C and 14 °C. **Question 3:** Determine the solubility of salicylic acid at 99 °C and 14 °C

NOTE: If you did not recrystallize both benzoic acid and salicylic acid, substitute phthalic acid for the one you are missing. If you only recrystallized one compound, make a note of that here!

$$\begin{aligned} \text{Solubility of Benzoic Acid at } 99^\circ\text{C} &= (\text{initial mass B.A. used (g)}/\text{volume water used at } 99^\circ\text{C (mL)}) \times 100\text{mL} \\ &= (\text{roughly } 0.200\text{g B.A.}/\text{volume used (mL)}) \times 100\text{mL} \end{aligned}$$

$$\text{Solubility of Benzoic Acid at } 14^\circ\text{C} = \frac{(\text{initial mass B.A. used (g)} - \text{mass B.A. recovered (g)})}{\text{volume water used at } 99^\circ\text{C (mL)}} \times 100\text{mL}$$

Question 4a: What is your percent recovery for naphthalene. **Question 4b:** What is your percent recovery for biphenyl. **If you only recrystallized one compound, make a note of that here!**

$$\text{Percent Recovery Naphthalene} = \frac{\text{recovered mass N.}}{\text{mass N. used}} \times 100\%$$