

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

Applying the Concept of Stoichiometry, Limiting Reactants and Interpreting Graphics  
Preparation of Salicylic Acid

STUDENT #1		STUDENT #2	
Mass of flask	38.820 g	Mass of flask	37.979 g
Flask + C <sub>7</sub> H <sub>6</sub> O <sub>3</sub>	39.961 g	Flask + C <sub>7</sub> H <sub>6</sub> O <sub>3</sub>	40.010 g
Volume of C <sub>4</sub> H <sub>6</sub> O <sub>3</sub>	5.0 mL	Volume of C <sub>4</sub> H <sub>6</sub> O <sub>3</sub>	5.0 mL
Mass of watch glass	22.744 g	Mass of watch glass	21.688 g
Watch glass & C <sub>9</sub> H <sub>8</sub> O <sub>4</sub>	24.489 g	Watch glass & C <sub>9</sub> H <sub>8</sub> O <sub>4</sub>	24.197 g

Two students prepared aspirin according to the following reaction in which acetic anhydride, C<sub>4</sub>H<sub>6</sub>O<sub>3</sub>, reacts with salicylic acid, C<sub>7</sub>H<sub>6</sub>O<sub>3</sub>, to form aspirin, C<sub>9</sub>H<sub>8</sub>O<sub>4</sub> and acetic acid, C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>.



The procedure involved heating the reaction mixture in a water bath for 15 minutes at 75°C, not to exceed 80°C. The mixture was removed from the water bath and distilled water was added to decompose any unreacted acetic anhydride. The mixture was then placed in an ice bath for 5 minutes to facilitate the formation of aspirin crystals. The aspirin crystals were collected using filtration. The aspirin crystals were dried and then transferred to a watch glass and massed.

Because their grades were partially based on accuracy, both students used their very best lab technique. Which student got the better grade and why?

- Determine the molar masses of:
  - acetic anhydride, C<sub>4</sub>H<sub>6</sub>O<sub>3</sub> : \_\_\_\_\_ g/mol
  - salicylic acid, C<sub>7</sub>H<sub>6</sub>O<sub>3</sub> : \_\_\_\_\_ g/mol
  - aspirin, C<sub>9</sub>H<sub>8</sub>O<sub>4</sub> : \_\_\_\_\_ g/mol
- How many moles of salicylic acid were added to the reaction mixture?
  - Student 1: \_\_\_\_\_ mol
  - Student 2: \_\_\_\_\_ mol
- Given the density of acetic anhydride to be 1.05 g/mL, what was the mass of the acetic anhydride added to the reaction? (use density to convert mL to grams) How many moles of acetic acid were added?
  - Student 1: \_\_\_\_\_ g  
\_\_\_\_\_ mol
  - Student 2: \_\_\_\_\_ g  
\_\_\_\_\_ mol
- According to the mole ratios in the given reaction, what is the limiting reactant for this reaction? (explain) \_\_\_\_\_
- What is the theoretical yield, in grams, of aspirin in each reaction?
  - Student 1: \_\_\_\_\_ g
  - Student 2: \_\_\_\_\_ g
- What was the actual yield, in grams, of aspirin in each reaction?
  - Student 1: \_\_\_\_\_ g
  - Student 2: \_\_\_\_\_ g
- What was the percent yield in each reaction?
  - Student 1: \_\_\_\_\_ %
  - Student 2: \_\_\_\_\_ %
- Evaluate your answers. Which student got the better grade and why?  
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