Name: ANSWERS Date: _____

**BCI SCIENCE**
**SCH 4CI**

**Worksheet:**
**LR & Percent Yield**

1. **Aspirin, $C_9H_8O_4$, is synthesized by the reaction of salicylic acid, $C_7H_6O_3$, with acetic anhydride, $C_4H_6O_3$.**
   **$2C_7H_6O_3 + C_4H_6O_3 \rightarrow 2\,C_9H_8O_4 + H_2O$**
   **(a) When 20.0 g of $C_7H_6O_3$ and 20.0g of $C_4H_6O_3$ react, which is the limiting reagent?**

$n_{C_7H_6O_3} = \frac{m}{M}$
$= \frac{20g}{138.121 g/mol}$
$\doteq 0.1448\ mol$

$n_{C_4H_6O_3} = \frac{m}{M}$
$= \frac{20g}{102.088}$
$\doteq 0.1959 mol$

$\frac{2\ mol\ C_7H_6O_3}{0.1448\ mol} = \frac{2\ mol\ C_9H_8O_4}{x}$
$x = 0.1448 mol\ C_9H_8O_4$

$\frac{1\ mol\ C_4H_6O_3}{0.1959\ mol} = \frac{2\ mol\ C_9H_8O_4}{x}$
$x = 0.3918\ mol\ C_9H_8O_4$

$\therefore C_4H_6O_3$ is the limiting reactant.

   **(b) 'What mass in grams of aspirin are formed?**

$m_{C_9H_6O_3} = nM$
$= (0.1448)(162.14)$
$\doteq 23.48g$

$\therefore$ 23.48g of asprin is formed.

2. **Huge quantities of sulfur dioxide are produced from zinc sulfide by means of the following reaction.**
   **$2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$**
   **If the typical yield is 86.78%, how much $SO_2$ should be expected if 4897g of ZnS are used?**

$n_{ZnS} = \frac{m}{M}$
$= \frac{4897g}{97.46 g/mol}$
$= 50.25\ mol$

$\frac{2\ mol\ ZnS}{50.25\ mol} = \frac{2\ mol\ SO_2}{x}$
$x = 50.25\ mol\ SO_2$

$m_{SO_2} = nM$
$= (50.25)(64.06)$
$= 3219.17g$

$AY_{SO_2} = \frac{(TY)(\%Y)}{100}$
$= \frac{(3219.17)(86.78)}{100}$
$\doteq 2793.6\ g$

$\therefore$ 2793.6g of $SO_2$ is expected.

3. **In the commercial production of the element arsenic, arsenic(III) oxide is heated with carbon, which reduces the oxide to the metal according to the following equation:**
   **$2As_2O_3 + 3C \rightarrow 3CO_2 + 4As$**
   **If 8.87g of $As_2O_3$ is used in the reaction and 5.33 g of As is produced, what is the percent yield?**

$n_{As_2O_3} = \frac{m}{M}$
$= \frac{8.87}{197.981}$
$\doteq 0.0448 mol$

$\frac{2\ mol\ As_2O_3}{0.0448 mol} = \frac{4\ mol\ As}{x}$
$x = 0.0896\ mol\ As$

$m_{As} = nM$
$= (0.0896)(74.922)$
$\doteq 6.71g$

$\%Y = \frac{AY}{TY} \times 100$
$= \frac{5.33}{6.71} \times 100$
$\doteq 79.4\%$

$\therefore$ the %Y is 79.4%