

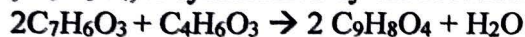
## BCI SCIENCE

## SCH 4CI

## Worksheet:

## LR &amp; Percent Yield

1. Aspirin,  $C_9H_8O_4$ , is synthesized by the reaction of salicylic acid,  $C_7H_6O_3$ , with acetic anhydride,  $C_4H_6O_3$ .



- (a) When 20.0 g of  $C_7H_6O_3$  and 20.0g of  $C_4H_6O_3$  react, which is the limiting reagent?

$$n_{C_7H_6O_3} = \frac{m}{M}$$

$$= \frac{20g}{138.121g/mol}$$

$$\doteq 0.1448 \text{ mol}$$

$$n_{C_4H_6O_3} = \frac{m}{M}$$

$$= \frac{20g}{102.088}$$

$$\doteq 0.1959 \text{ mol}$$

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

$$x = 0.1448 \text{ mol } C_9H_8O_4$$

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

$$x = 0.3918 \text{ mol } C_9H_8O_4$$

$\therefore C_4H_6O_3$  is the limiting reactant.

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

$$m_{C_9H_8O_4} = nM$$

$$= (0.1448)(162.14)$$

$$\doteq 23.48g$$

$\therefore 23.48g$  of aspirin is formed.

2. Huge quantities of sulfur dioxide are produced from zinc sulfide by means of the following reaction.



If the typical yield is 86.78%, how much  $SO_2$  should be expected if 4897g of  $ZnS$  are used?

$$n_{ZnS} = \frac{m}{M}$$

$$= \frac{4897g}{97.46g/mol}$$

$$= 50.25 \text{ mol}$$

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

$$x = 50.25 \text{ mol } SO_2$$

$$m_{SO_2} = nM$$

$$= (50.25)(64.06)$$

$$= 3219.17g$$

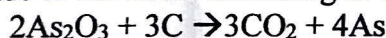
$$AY_{SO_2} = \frac{(TY)(\%Y)}{100}$$

$$= \frac{(3219.17)(86.78)}{100}$$

$$\doteq 2793.6g$$

$\therefore 2793.6g$  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:



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?

$$n_{As_2O_3} = \frac{m}{M}$$

$$= \frac{8.87}{197.981}$$

$$\doteq 0.0448 \text{ mol}$$

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

$$x = 0.0896 \text{ mol } As$$

$$m_{As} = nM$$

$$= (0.0896)(74.922)$$

$$\doteq 6.71g$$

$$\%Y = \frac{AY}{TY} \times 100$$

$$= \frac{5.33}{6.71} \times 100$$

$$\doteq 79.4\%$$

$\therefore$  the %Y is 79.4%