

## Answer on the question #54711 – Chemistry – General chemistry

### Question:

Given 7.10 g of butanoic acid and excess ethanol, how many grams of ethyl butyrate would be synthesized, assuming a complete 100% yield?

Express your answer in grams to three significant figures.

A chemist ran the reaction and obtained 5.50 g of ethyl butyrate. What was the percent yield?

Express your answer as a percent to three significant figures.

The chemist discovers a more efficient catalyst that can produce ethyl butyrate with a 78.0% yield.

How many grams would be produced from 7.10 g of butanoic acid and excess ethanol?

Express your answer in grams to three significant figures.

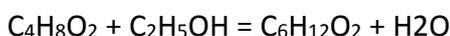
### Answer:

- A. Given 7.10 g of butanoic acid and excess ethanol, how many grams of ethyl butyrate would be synthesized, assuming a complete 100% yield?

Express your answer in grams to three significant figures.

Solution:

The reaction equation is:



One can note that the number of the moles of butanoic acid and ethyl butyrate is equal in the reaction. That means:

$$n(\text{C}_4\text{H}_8\text{O}_2) = n(\text{C}_6\text{H}_{12}\text{O}_2)$$
$$\frac{m(\text{C}_4\text{H}_8\text{O}_2)}{M(\text{C}_4\text{H}_8\text{O}_2)} = \frac{m(\text{C}_6\text{H}_{12}\text{O}_2)}{M(\text{C}_6\text{H}_{12}\text{O}_2)}; \quad m(\text{C}_6\text{H}_{12}\text{O}_2) = \frac{m(\text{C}_4\text{H}_8\text{O}_2)}{M(\text{C}_4\text{H}_8\text{O}_2)} * M(\text{C}_6\text{H}_{12}\text{O}_2)$$

Then, assuming 100% yield, the mass of ethyl butyrate produced is:

$$m(\text{C}_6\text{H}_{12}\text{O}_2) = \frac{7.10}{88.11} * 116.16 = 9.36 \text{ g}$$

- B. A chemist ran the reaction and obtained 5.50 g of ethyl butyrate. What was the percent yield?

Express your answer as a percent to three significant figures.

Solution:

The percent yield is:

$$\eta = \frac{m(\text{exper.})}{m(\text{theoretical})} * 100\% = \frac{5.50}{9.36} * 100\% = 58.8\%$$

- C. The chemist discovers a more efficient catalyst that can produce ethyl butyrate with a 78.0% yield. How many grams would be produced from 7.10 g of butanoic acid and excess ethanol?

Express your answer in grams to three significant figures.

Solution:

When the 78% yield is reached, the result mass of the ethyl butyrate is:

$$m = \eta * m(\text{theor}) = 0.78 * 9.36 = 7.30 \text{ g}$$