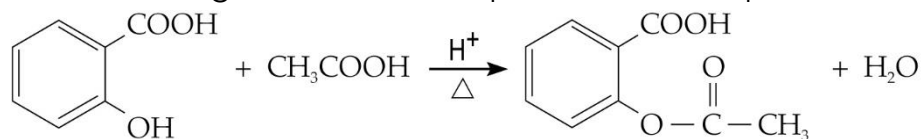


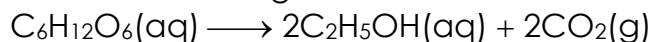
## Quiz (Atom Economy)

1. Consider the following reaction for the production of aspirin:



What is the atom economy for the production of aspirin?  
(Relative atomic masses: H = 1.0, C = 12.0, O = 16.0)

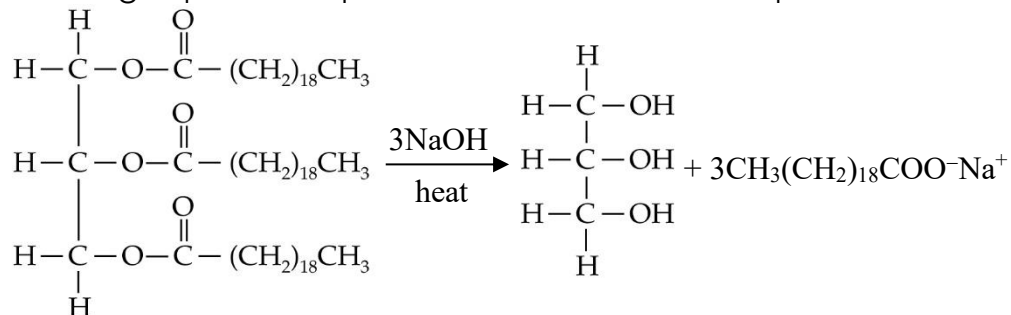
2. Consider the following reaction:



If  $\text{CO}_2(\text{g})$  is considered as the by-product, what is the atom economy of the reaction?

(Relative atomic masses: H = 1.0, C = 12.0, O = 16.0)

3. The following equations represent the reaction for the production of soap:



What is the atom economy of the production of soap?

(Relative atomic masses: H = 1.0, C = 12.0, O = 16.0, Na = 23.0)

## Suggested Answer

- Mass of atoms in 1 mole of  $C_7H_6O_3 = 12.0 \times 7 + 1.0 \times 6 + 16.0 \times 3 = 138 \text{ g}$   
Mass of atoms in 1 mole of  $CH_3COOH = 12.0 \times 2 + 1.0 \times 4 + 16.0 \times 2 = 60.0 \text{ g}$   
Mass of atoms in 1 mole of aspirin =  $12.0 \times 9 + 1.0 \times 8 + 16.0 \times 4 = 180 \text{ g}$   
Atom economy =  $180 / (138 + 60.0) \times 100\% = 90.9\%$
- Mass of atoms in 1 mole of  $C_6H_{12}O_6 = 12.0 \times 6 + 1.0 \times 12 + 16.0 \times 6 = 180 \text{ g}$   
Mass of atoms in 2 moles of  $C_2H_5OH = (12.0 \times 2 + 1.0 \times 6 + 16.0) \times 2 = 92.0 \text{ g}$   
Atom economy of the reaction =  $92.0 / 180 \times 100\% = 51.1\%$
- Mass of atoms in 1 mole of the triester =  $12.0 \times 63 + 1.0 \times 122 + 16.0 \times 6 = 974 \text{ g}$   
Mass of atoms in 3 moles of  $NaOH = (23.0 + 16.0 + 1.0) \times 3 = 120 \text{ g}$   
Mass of atoms in 3 moles of  $CH_3(CH_2)_{18}COO^-Na^+$   
=  $(12.0 \times 20 + 1.0 \times 39 + 16.0 \times 2 + 23.0) \times 3 = 1002 \text{ g}$   
Atom economy of the reaction =  $1002 / (974 + 120) \times 100\% = 91.6\%$