

### 29632, Chemistry, Other

An unknown hydrocarbon was burned to produce 67.69 grams of CO<sub>2</sub> and 13.85 grams of H<sub>2</sub>O. The molecular mass is 78. What is the empirical and molecular formula?

#### Solution:

The burning of an unknown hydrocarbon is occurred by the following reaction:



The molar mass of CO<sub>2</sub> is 44 g/mol.

The number of moles of CO<sub>2</sub> which produced after an unknown hydrocarbon was burned is:  
 $67.69/44=1.54$  moles.

The molar mass of H<sub>2</sub>O is 18 g/mol.

So, the number of moles of H<sub>2</sub>O is:  $13.85/18=0.77$  moles.

From the equation of the reaction, an unknown hydrocarbon compound should have: 1.54 moles of C and 1.54 moles of H or 3 moles of C and 3 moles of H. The simplest empirical formula of compound is C<sub>3</sub>H<sub>3</sub> and its molar mass is:  $12 \cdot 3 + 3 \cdot 1 = 39$  g/mol. The molar mass of real compound is 78 g/mol, so the real molecular formula of the compound is C<sub>6</sub>H<sub>6</sub>.

**Answer:** The molecular formula of the compound is C<sub>6</sub>H<sub>6</sub>.