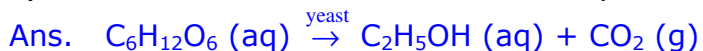


A container with 100.0 mL of water has 15.0 grams of glucose ($C_6H_{12}O_6$) dissolved in it. When yeast is added to the solution, ethyl alcohol (or ethanol, C_2H_5OH) and carbon dioxide are produced, according to the following chemical reaction:

a) Write out the unbalanced chemical equation for this reaction.



b) Balance this chemical reaction.



c) What is the molar mass for glucose, ethanol and carbon dioxide respectively?

Ans. $C_6H_{12}O_6$:

| Element | Atomic Mass | # of Atoms | Net Molar Mass |
|--------------|-------------|------------|----------------|
| C | 12.01 | 6 | 72.06 |
| H | 1.008 | 12 | 12.096 |
| O | 16.00 | 6 | 96.00 |
| Molar Mass → | | | 180.16 |

C_2H_5OH :

| Element | Atomic Mass | # of Atoms | Net Molar Mass |
|--------------|-------------|------------|----------------|
| C | 12.01 | 2 | 24.02 |
| H | 1.008 | 6 | 6.048 |
| O | 16.00 | 1 | 16.00 |
| Molar Mass → | | | 46.07 |

CO_2 :

| Element | Atomic Mass | # of Atoms | Net Molar Mass |
|--------------|-------------|------------|----------------|
| C | 12.01 | 1 | 12.01 |
| O | 16.00 | 2 | 32.00 |
| Molar Mass → | | | 44.01 |

d) How many moles of glucose are in the water before the yeast is added?

Ans.

$$\# \text{ mol of } C_6H_{12}O_6 = \left(\frac{15.0 \text{ g } C_6H_{12}O_6}{1} \right) \left(\frac{1 \text{ mol } C_6H_{12}O_6}{180.16 \text{ g } C_6H_{12}O_6} \right) = 8.33 \times 10^{-2} \text{ mol } C_6H_{12}O_6$$

e) How many moles of ethanol are produced when this reaction runs to completion?

$$\# \text{ mol of } C_2H_5OH = \left(\frac{8.33 \times 10^{-2} \text{ mol } C_6H_{12}O_6}{1} \right) \left(\frac{2 C_2H_5OH}{1 C_6H_{12}O_6} \right) = 1.67 \times 10^{-1} \text{ mol } C_2H_5OH$$

f) How many grams of ethanol are produced in the completed reaction?

$$\# \text{ grams of } C_2H_5OH = \left(\frac{1.67 \times 10^{-1} \text{ mol } C_2H_5OH}{1} \right) \left(\frac{46.07 \text{ g } C_2H_5OH}{1 \text{ mol } C_2H_5OH} \right) = 7.69 \text{ g } C_2H_5OH$$

g) How many grams of carbon dioxide are produced in the completed reaction?

$$\text{Ans. } \# \text{ grams of } CO_2 = 15.0 \text{ g} - 7.69 \text{ g} = 7.3 \text{ g } CO_2$$

Or, alternative solution (note the rounding error...):

$$\# \text{ grams of } CO_2 = \left(\frac{1.67 \times 10^{-1} \text{ mol } CO_2}{1} \right) \left(\frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} \right) = 7.35 \text{ g } CO_2$$