

## Answer on the question #65789, Chemistry / Other

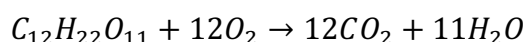
### Question:

The combustion of sugar, in a bomb calorimeter is similar to the oxidation of sugar in the body. A student ate three sugar cubes, with the masses of 6.84g, 6.75g and 6.79g.

- A) calculate the overall molar enthalpy of oxidation of sugar in the body.
- B) using these three sugar cubes as representative of regular-sized cubes, determine the amount of energy released by an average-sized cube.

### Solution:

- A) The reaction of combustion of sugar is:



According to Hess's law, molar enthalpy of combustion of sugar is:

$$\Delta H_c^0(C_{12}H_{22}O_{11}) = 12\Delta H_f^0(CO_2) + 11\Delta H_f^0(H_2O) - \Delta H_f^0(C_{12}H_{22}O_{11})$$

Enthalpy of formation for sugar, carbon dioxide and water are -2221.2 kJ/mol, -393.51 kJ/mol and -285.830 kJ/mol, respectively. Then, molar enthalpy of oxidation of sugar in the body is:

$$\begin{aligned}\Delta H_c^0(C_{12}H_{22}O_{11}) &= 12 \cdot (-393.51) + 11 \cdot (-285.830) + 2221.2 \\ &= -5645.05 \text{ kJ/mol}\end{aligned}$$

- B) Average mass of the sugar cube is:

$$m = \frac{6.84 + 6.75 + 6.79}{3} = 6.79 \text{ (g)}$$

Molar mass of sugar is 342.2965 g/mol. Then average sugar cube contains the following number of the moles of sugar:

$$n = \frac{m}{M} = \frac{6.79 \text{ (g)}}{342.2965 \text{ (g mol}^{-1}\text{)}} = 0.01985 \text{ mol}$$

So, the amount of energy, released by an average-sized cube is:

$$\begin{aligned}Q &= n \cdot \Delta H_c^0(C_{12}H_{22}O_{11}) = 0.01985 \text{ (mol)} \cdot 5645.05 \text{ (kJ mol}^{-1}\text{)} \\ &= 112 \text{ kJ, or } 26.8 \text{ kcal.}\end{aligned}$$

**Answer:** A)  $-5645.05 \text{ kJ/mol}$ ; B)  $112 \text{ kJ, or } 26.8 \text{ kcal}$

Thermochemistry data was taken from <http://webbook.nist.gov/chemistry/> website.