## Answer on the Question #63518, Chemistry / General chemistry

The automobile fuel called E85 consists of 85% ethanol and 15% gasoline. E85 can be used in so-called flex-fuel vehicles (FFVs), which can use gasoline, ethanol, or a mix as fuels. Assume that gasoline consists of a mixture of octanes (different isomers of C8H18), that the average heat of combustion of C8H18(l) is 5400 kJ/mol, and that gasoline has an average density of 0.70 g/mL. The density of ethanol is 0.79 g/mL.

1) Assume that the density and heat of combustion of E85 can be obtained by using 85% of the values for ethanol and 15% of the values for gasoline. How much energy could be released by the combustion of 3.5 L of E85?

## Solution:

The main part of energy calculation is the aim to understand which volume takes 85% of ethanol and 15% of gasoline in 3.5 L:

$$V(Ethanol) = V \cdot 0.85 = 3.5 \cdot 0.85 = 2.975\ L$$

$$V(gasoline) = V \cdot 0.15 = 3.5 \cdot 0.15 = 0.525\ L$$

The heat of combustion is the ration between the produced energy and number of moles of the substance releases energy by the combustion to carbon dioxide and water:

$$\Delta_c H^0 = \frac{E}{n}$$

The mole number of each fuel can be rationalize by the following equation:

$$n = \frac{m}{M} = \frac{d \cdot V}{M}$$

$$n(Ethanol) = \frac{0.79\ g/mL \cdot 2.975 \cdot 10^{-3} mL}{46 g/mol} = 5.1 \cdot 10^{-5} mol$$

$$n(gasoline) = \frac{0.70\ g/mL \cdot 0.525 \cdot 10^{-3} mL}{114 g/mol} = 3.2 \cdot 10^{-6} mol$$

The energy what releases by the combustion of the E85:

$$E = E(Ethanol) + E(gasoline)$$

$$E(Ethanol) = \Delta_c H^0(Ethanol) \cdot n(Ethanol) = 1370 \frac{kJ}{mol} \cdot 5.1 \cdot 10^{-5} mol = 69.9\ J$$

$$E(gasoline) = \Delta_c H^0(gasoline) \cdot n(gasoline) = 5400 \frac{kJ}{mol} \cdot 3.2 \cdot 10^{-6} mol = 17.3\ J$$

$$E = E(Ethanol) + E(gasoline) = 69.9\ J + 17.3\ J = 87.2\ J$$

**Answer:** the energy releases by the E85 combustion equal to 87.2 J.