

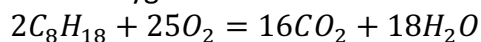
Answer on the question #59815, Chemistry / Other

Question:

Calculate the number of pounds of CO₂ released into the atmosphere when a 21.0-gallon tank of gasoline is burned in an automobile engine. Assume that gasoline is primarily octane, C₈H₁₈, and that the density of gasoline is 0.692 g·mL⁻¹ (this assumption ignores additives). Also assume complete combustion.

Solution:

Reaction equation of gasoline with oxygen is:



Then, number of the moles of octane and CO₂ relate as:

$$n(C_8H_{18}) = \frac{n(CO_2)}{8}$$

To calculate the number of the moles of octane, we divide its mass by the molar mass:

$$n(C_8H_{18}) = \frac{m(C_8H_{18})}{M(C_8H_{18})}$$
$$m(C_8H_{18}) = V \cdot \rho = 4.55 \cdot 21 (L) \cdot 0.692 \cdot 10^3 (g \cdot L^{-1}) = 6.612 \cdot 10^4 g$$
$$n(C_8H_{18}) = \frac{6.612 \cdot 10^4 g}{114.23 g \cdot mol^{-1}} = 5.79 \cdot 10^2 mol$$

Then, mass of CO₂ is the product of its molar mass and number of the moles:

$$m(CO_2) = n(CO_2) \cdot M(CO_2) = 8 \cdot 5.79 \cdot 10^2 (mol) \cdot 44.01 (g \cdot mol^{-1}) = 2.04 \cdot 10^5 g$$
$$m(CO_2) = 0.454 (lb \cdot kg^{-1}) \cdot 2.04 \cdot 10^2 (kg) = 92.5 lb$$

Answer: 92.5 lb