

## The JETS Challenge

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### Challenge 75 – The Chimney Challenge

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**Problem:**

A gas furnace produces CO<sub>2</sub> and H<sub>2</sub>O that must be exhausted through a chimney or smokestack. To size that stack, it is necessary to know the mass flow rate of exhaust gases produced. A general formula to determine M, the exhaust gas mass flow per heat input (kg per MJ), is given by

$$M = 303 \left( 0.159 + \frac{10.72}{\%CO_2} \right)$$

where % CO<sub>2</sub> is the percent carbon dioxide in the gases.

When the mass flow rate is 27,500 kg/hr from a 60 MJ / hr fuel input, find the percent CO<sub>2</sub>.

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**Solution:**

$$\begin{aligned} M &= 27,500 \frac{Kg}{hr} \cdot \frac{1 hr}{60 MJ} \\ &= \frac{27,500}{60} \frac{Kg}{MJ} \\ &= 458.\bar{3} \frac{Kg}{MJ} \end{aligned}$$

$$458.\bar{3} = 303 \left( 0.159 + \frac{10.72}{\%CO_2} \right)$$

$$\frac{458.\bar{3}}{303} = .159 + \frac{10.72}{\%}$$

$$1.35365 = \frac{10.72}{\%}$$

$$\% CO_2 = 7.92\%$$

