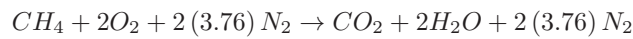


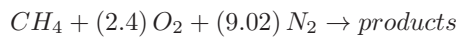
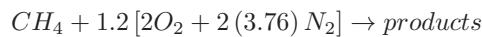
36.16 Methane is burned with 20% excess air. What is the air-to-fuel ratio?

- A. $14 \frac{lb}{lb}$
- B. $17 \frac{lb}{lb}$
- C. $21 \frac{lb}{lb}$
- D. $24 \frac{lb}{lb}$

Look up the table **Combustion Reactions of Common Fuel Constituents** and find the combustion reaction for methane burned stoichiometrically in air. Include 3.76 nitrogen molecules for every 1 oxygen molecule since nitrogen has been omitted in the table. Nitrogen does not participate in the reaction; however, it does contribute mass to the air and thus impacts the air-to-fuel ratio.



Add 20% excess air. Air-to-fuel ratio applies only to the reactants, so it is not necessary to balance the reaction and write out the product side.



Calculate the air-to-fuel ratio by multiplying the number of moles of each constituent times the atomic weight and dividing the air mass by the fuel mass. Use the **Periodic Table** to look up atomic weights as needed.

$$\frac{m_{air}}{m_{fuel}} = \frac{n_{O_2} M_{O_2} + n_{N_2} M_{N_2}}{n_{CH_4} M_{CH_4}} = \frac{(2.4)(32) + (9.02)(28)}{(1)(16)} = 20.6 \frac{lb}{lb}$$

Alternatively, in the **Combustion Reactions** table, notice the heading for **Stoichiometric Oxygen and Air Requirements**. The amount of air required to burn methane stoichiometrically is given as $17.24 \frac{lb}{lb}$. Increase this value by 20% to account for excess air.

$$(1.2) \left(17.24 \frac{lb}{lb} \right) = 20.7 \frac{lb}{lb}$$

Answer C