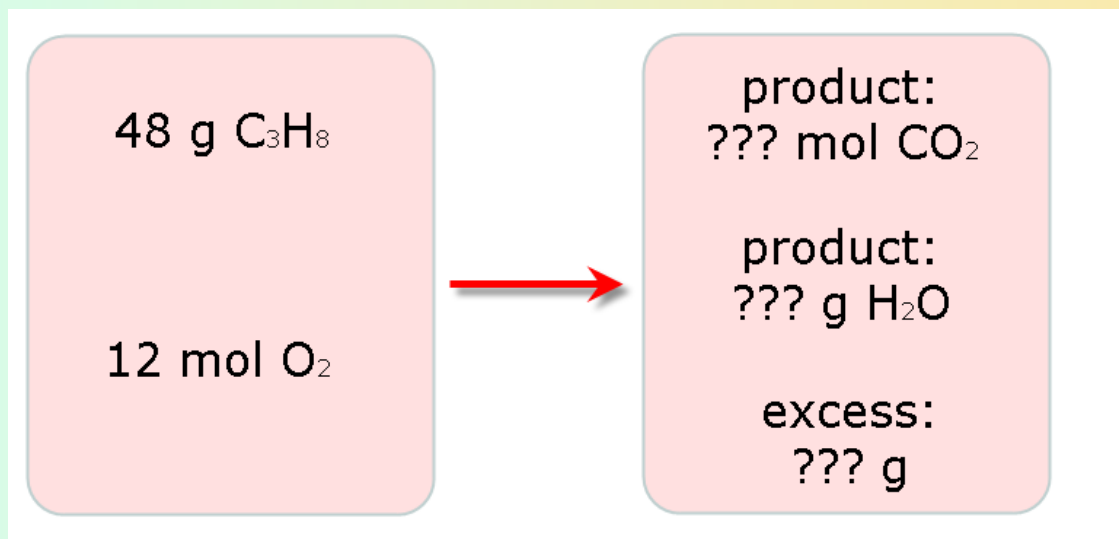


## Limiting reactants: exercise

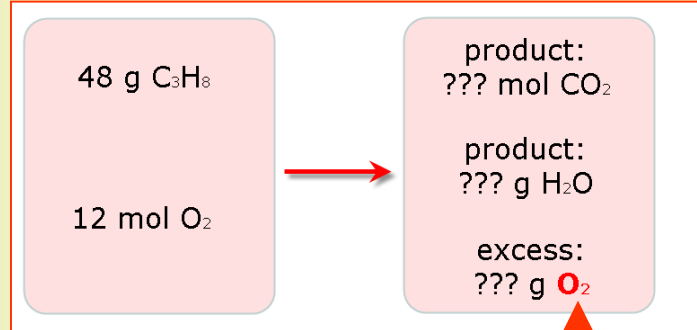
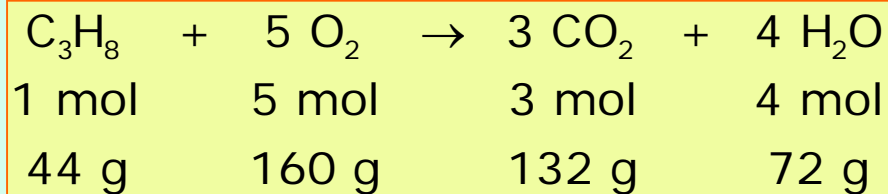
A tank contains 48 grams of propane and 12 moles of oxygen. Suppose that both reactants combine together to give carbon dioxide and water as products (combustion).

Calculate the amount of water formed (in grams), the amount of carbon dioxide (in moles) and the excess of the reactant (in grams) when the reaction is complete.

Atomic weights: O=16; H=1; C=12



## Limiting reactants: exercise



### Determination of the limiting reactant and the reactant in excess

To determine which is the limiting reactant, we need to compare the amounts of reactants we have with the values we get from the equation's table

**LIMITING  
REACTANT:  
 $C_3H_8$**

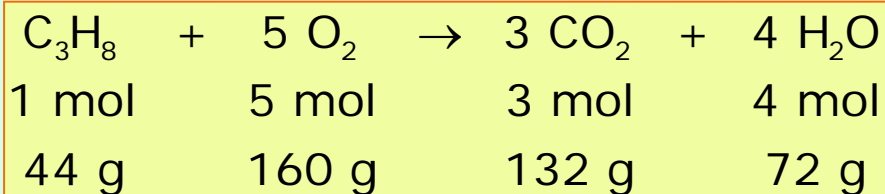
$$x(C_3H_8) = \frac{48 \text{ g (in the container)}}{44 \text{ g (value of the table)}} = 1.09 \text{ times the value of the table}$$

$$x(O_2) = \frac{12 \text{ mol (in the container)}}{5 \text{ mol (value of the table)}} = 2.4 \text{ times the value of the table}$$

**REACTANT  
IN EXCESS:  
 $O_2$**

## Limiting reactants: exercise

Calculation of the product formed: CO<sub>2</sub> (in moles) and water (in grams)



48 g C<sub>3</sub>H<sub>8</sub>

12 mol O<sub>2</sub>

product:  
**3.27** mol CO<sub>2</sub>

product:  
**78.55** g H<sub>2</sub>O

excess:  
??? g O<sub>2</sub>

$$n(\text{CO}_2) = 48 \text{ g C}_3\text{H}_8 \times \frac{3 \text{ mol CO}_2}{44 \text{ g C}_3\text{H}_8} = 3.27 \text{ mol CO}_2$$

The amount of product formed has to be calculated using the value of the limiting reactant:

**48 g C<sub>3</sub>H<sub>8</sub>**

$$m(\text{H}_2\text{O}) = 48 \text{ g C}_3\text{H}_8 \times \frac{72 \text{ g H}_2\text{O}}{44 \text{ g C}_3\text{H}_8} = 78.55 \text{ g H}_2\text{O}$$

## Limiting reactants: exercise

### Determination of the excess of reactant

First, we have to calculate the amount of the reactant transformed into product, and later calculate the excess by subtraction.

**12 mol oxygen**

REACTANT SPENT

$$n(\text{O}_2) = 48 \text{ g C}_3\text{H}_8 \times \frac{5 \text{ mol O}_2}{44 \text{ g C}_3\text{H}_8} = 5.45 \text{ mol O}_2$$

REACTANT IN EXCESS

$$n_{\text{excess}}(\text{O}_2) = 12 \text{ mol} - 5.45 \text{ mol} = 6.55 \text{ mol O}_2$$

REACTANT IN EXCESS

$$m_{\text{excess}}(\text{O}_2) = 6.55 \text{ mol O}_2 \times \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} = 209.6 \text{ g O}_2$$

48 g C<sub>3</sub>H<sub>8</sub>

12 mol O<sub>2</sub>



product:  
**3.27 mol CO<sub>2</sub>**

product:  
**78.55 g H<sub>2</sub>O**

excess:  
**209.6 g O<sub>2</sub>**