Limiting reactants

WORKIT!

In an experiment, 3.2 g of NH_3 reacts with 3.5 g of O_2. Find the limiting reactant.

$NH_3 + O_2 \rightarrow NO + H_2O$

Step 1 Balance the equation.

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

Step 2 Calculate the number of moles for each of the reactants.

NH_3: $3.25 g / 17 g mol^{-1} = 0.19$ moles O_2

$3.5 g / 32 g mol^{-1} = 0.11$ moles

Step 3 Compare the ratios of what we have versus what the balanced equation tells us we need.

From the equation we can see that 4 moles of NH_3 react with 5 moles of O_2. This tells us that if we have 0.19 moles of NH_3 we need 0.23 moles of O_2.

What we actually have is 0.19 moles of NH_3 reacting with 0.11 moles of O_2.

This tells us that NH_3 was added to excess and O_2 is the limiting factor for the reaction.

Propane is a fuel that is commonly used in portable stoves and increasingly in vehicles, where it is known as liquid petroleum gas (LPG). It completely combusts in the presence of excess oxygen. The chemical equation is shown below:

..... $C_3H_8(l)$ + ... $O_2(g) \rightarrow$ ..... $CO_2(g)$ + ... $H_2O(g)$

To develop an efficient car engine, a manufacturer is testing mixes with different amounts of oxygen and propane. In this test, 14.8 g of C_3H_8 reacts with 3.44 g of O_2.

a Balance the equation above. (2 marks, ★★)

b Calculate the mass of carbon dioxide produced in the reaction. (2 marks, ★★★)

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c Identify the limiting reagent and suggest how the manufacturer could change the quantities of propane and oxygen to maximise the efficiency of an engine. (5 marks, ★★★★)

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