



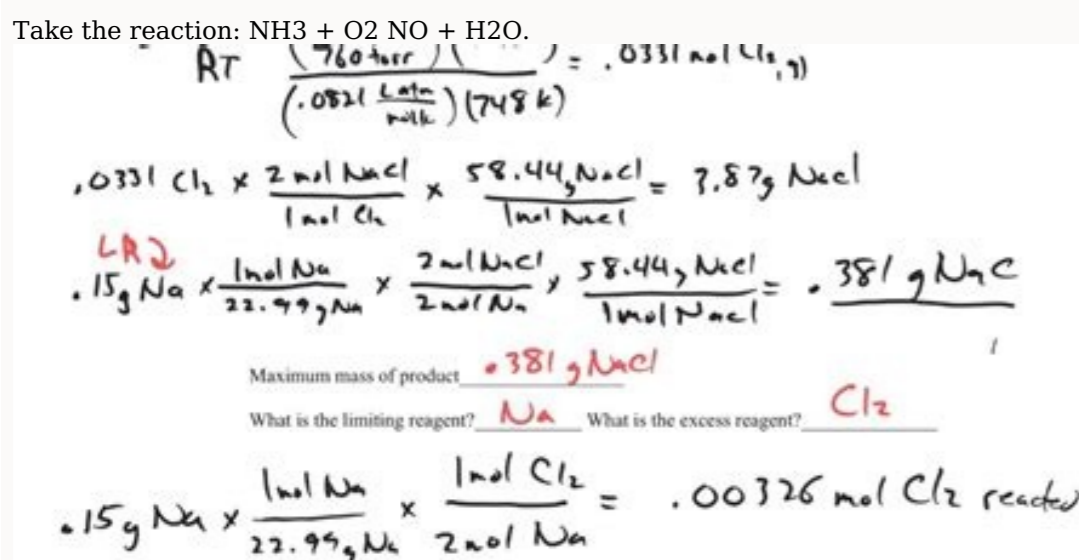
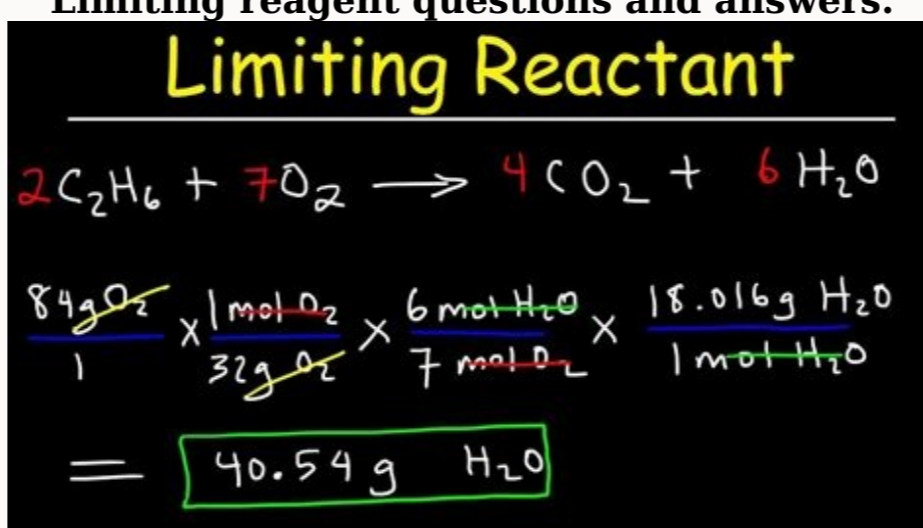
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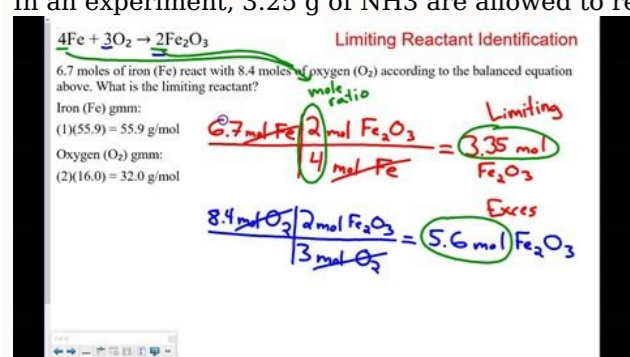
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Limiting reagent problems and answers

Explain limiting reagent. Limiting reagent problems and answers pdf. What is a limiting reactant problem. Limiting reagent and percent yield practice problems answers. Limiting reactant problem example. Limiting reagent questions and answers.



In an experiment, 3.25 g of NH3 are allowed to react with 3.50 g of O2. a. Which reactant is the limiting reagent? O2 b.



How many grams of NO are formed? 2.63 g NO c.

Name: _____ Date: _____ Period: _____

ANSWER KEY

Limiting Reagent & Percent Yield Practice Worksheet

1. When copper (II) chloride reacts with sodium nitrate, copper (II) nitrate and sodium chloride are formed.

a. Write the balanced equation for the reaction given above:

$$CuCl_2 + NaNO_3 \rightarrow Cu(NO_3)_2 + NaCl$$
$$CuCl_2 + 2 NaNO_3 \rightarrow Cu(NO_3)_2 + 2 NaCl$$

b. If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how much sodium chloride can be formed?

$15g CuCl_2 \times \frac{1 mol CuCl_2}{134.45g CuCl_2} \times \frac{2 mol NaCl}{1 mol CuCl_2} \times \frac{58.44g NaCl}{1 mol NaCl} = 13g NaCl$

$20g NaNO_3 \times \frac{1 mol NaNO_3}{84.997g NaNO_3} \times \frac{2 mol NaCl}{2 mol NaNO_3} \times \frac{58.44g NaCl}{1 mol NaCl} = 13.8g NaCl$

Only 13g can be formed

c. What is the limiting reagent for the reaction in #2? **copper (II) chloride**

d. How many grams of copper (II) nitrate is formed?

$15g CuCl_2 \times \frac{1 mol CuCl_2}{134.45g CuCl_2} \times \frac{1 mol Cu(NO_3)_2}{1 mol CuCl_2} \times \frac{287.66g Cu(NO_3)_2}{1 mol Cu(NO_3)_2} = 20.9g Cu(NO_3)_2$

e. How much of the excess reagent is left over in this reaction?

$15g CuCl_2 \times \frac{1 mol CuCl_2}{134.45g CuCl_2} \times \frac{2 mol NaNO_3}{1 mol CuCl_2} \times \frac{84.997g NaNO_3}{1 mol NaNO_3} = 19g NaNO_3$

$20g NaNO_3 - 19g NaNO_3 = 1g NaNO_3$

f. If 11.3 grams of sodium chloride are formed in the reaction described in problem #2, what is the percent yield of this reaction?

$\frac{11.3g}{13.8g} \times 100\% = 86.9\%$

Percent yield = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$ percent

2. When lead (II) nitrate reacts with sodium iodide, sodium nitrate and lead (II) iodide are formed.

a. Balance the following equation:

$$Pb(NO_3)_2(aq) + 2 NaI(aq) \rightarrow PbI_2(s) + 2 NaNO_3(aq)$$

b. If I start with 25.0 grams of lead (II) nitrate and 15.0 grams of sodium iodide, how many grams of sodium nitrate can be formed?

$25.0g Pb(NO_3)_2 \times \frac{1 mol Pb(NO_3)_2}{331.214g Pb(NO_3)_2} \times \frac{2 mol NaNO_3}{1 mol Pb(NO_3)_2} \times \frac{84.997g NaNO_3}{1 mol NaNO_3} = 12.8g NaNO_3$

$15.0g NaI \times \frac{1 mol NaI}{149.89g NaI} \times \frac{2 mol NaNO_3}{2 mol NaI} \times \frac{84.997g NaNO_3}{1 mol NaNO_3} = 8.51g NaNO_3$

8.51g NaNO3 can be made

How much of the excess reactant remains after the reaction? 1.76 g NH3 left If 4.95 g of ethylene (C2H4) are combusted with 3.25 g of oxygen. a. What is the limiting reagent? O2 b. How many grams of CO2 are formed? 2.98 g CO2 Consider the reaction of C6H6 + Br2 C6H5Br + HBr a. What is the theoretical yield of C6H5Br if 42.1 g of C6H6 react with 73.0 g of Br2? 71.6 g C6H5Br b. If the actual yield of C6H5Br is 63.6 g, what is the percent yield? 88.8% Use the following reaction: C4H9OH + NaBr + H2SO4 C4H9Br + NaHSO4 + H2O If 15.0 g of C4H9OH react with 22.4 g of NaBr and 32.7 g of H2SO4 to yield 17.1 g of C4H9Br, what is the percent yield of this reaction? 61.6% Silicon nitride (Si3N4) is made by a combining Si and nitrogen gas (N2) at a high temperature. How much (in g) Si is needed to react with an excess of nitrogen gas to prepare 125 g of silicon nitride if the percent yield of the reaction is 95.0%? 79.1 g Si Souring of wine occurs when ethanol is converted to acetic acid by oxygen by the following reaction: C2H5OH + O2 CH3COOH + H2O.

A 1.00 L bottle of wine, labeled as 8.5% (by volume) ethanol, is found to have a defective seal. Analysis of 1.00 mL showed that there were 0.0274 grams of acetic acid in that 1.00 mL. The density of ethanol is 0.816 g/mL and the density of water is 1.00 g/mL.

14.6 g O2 b. [lista_de_los_derechos_humanos.pdf](#) What is the percent yield for the conversion of ethanol to acetic acid if O2 is in excess? 30.3% A reaction container holds 5.77 g of P4 and 5.77 g of O2. The following reaction occurs: P4 + O2 P4O6. If enough oxygen is available then the P4O6 reacts further: P4O6 + O2 P4O10. a. What is the limiting reagent for the formation of P4O10? O2 b. What mass of P4O10 is produced? 5.78 g P4O10 c. What mass of excess reactant is left in the reaction container? 5.76 g P4O6 remain in a chemical reaction, the limiting reagent is the reactant that determines the quantity of the products that are produced. The other reactants present in the reactions are sometimes found to be in excess since there is some leftover quantity of them after the limiting reagent is completely used up. The maximum amount of product that is produced is known as the theoretical yield. The limiting reagent should be identified to calculate the percentage yield of a reaction. Given the balanced chemical equation, that describes the reaction, there are many equivalent ways to identify the limiting reagent and calculate the excess quantities of other reagents in the reaction.

$2Mg + O_2 \rightarrow 2MgO$

What is the greatest amount of Mg that can be used in the reaction? Which reactant is in excess, and how many moles of it are there?

There are 7.8 moles of Mg and 4.7 moles of O2.

$\frac{7.8 mol Mg}{2} = 3.9 mol Mg$

$\frac{4.7 mol O_2}{1} = 4.7 mol O_2$

Mg is the limiting reagent

$7.8 mol Mg \times \frac{1 mol O_2}{2 mol Mg} = 3.9 mol O_2$

Excess O_2 = Total Reactant - Reactant

$4.7 mol O_2 - 3.9 mol O_2 = 0.8 mol O_2$

In this article, we will discuss what is limiting agent is, how to find limiting reagents and some limiting reagent questions. Limiting Reagent Definition Limiting reagents are defined as the substances which are entirely consumed in the completion of a chemical reaction. They are also referred to as limiting reactants or limiting agents. According to the stoichiometry of chemical reactions, a fixed amount of reactants is necessary for the reaction to complete. This reactant usually determines when the reaction would stop. The exact amount of reactant that would be needed to react with another element is calculated from the reaction stoichiometry. The limiting reagent depends on the mole ratio and not on the masses of the reactants present. Consider the following reaction for the formation of ammonia: $3H_2 + N_2 \rightarrow 2NH_3$ In the reaction shown above, 3 moles of hydrogen gas is required for the reaction with 1 mole of nitrogen gas for the formation of 2 moles of ammonia. But what if, during the time of the reaction, there are only 2 moles of hydrogen gas available with 1 mole of nitrogen? In this case, the entire quantity of nitrogen cannot be used since the entirety of nitrogen requires 3 moles of hydrogen gas to react. Therefore, the hydrogen gas is limiting the reaction and is hence called the limiting reagent for this reaction. Limiting Reagent Examples Let us now look at some of the limiting reagent examples. Example Consider the combustion of benzene which is represented by the following chemical equation: $2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$ It means that 15 moles of molecular oxygen O2 are needed to react with 2 moles of benzene C6H6. The amount of oxygen that is required for other quantities of benzene is calculated using cross-multiplication. For example, if 1.5 mol C6H6 is present, 11.25 mol O2 is required: $1.5 mol C_6H_6 \times \frac{15 mol O_2}{2 mol C_6H_6} = 11.25 mol O_2$ If in 18 mol O2 are present, there would be an excess of $(18 - 11.25) = 6.75 mol$ of unreacted oxygen when all of the benzene is consumed. Benzene is, therefore, the limiting reagent. guided meditation for sleep and relaxation short: How to Find Limiting Reagent in a Reaction? Let us now learn about how to determine limiting reagent in a reaction. There are two ways for how to calculate limiting reagent. One method is to find and compare the mole ratio of the reactants that are used in the reaction. Another method is to calculate the grams of products produced from the quantities of reactants in which the reaction which produces the smallest amount of product is the limiting reagent. Method 1: Finding the limiting reagent by looking at the number of moles of every reactant. First, determine the balanced chemical equation for the given chemical reaction. Then, convert all the given information into moles (by using molar mass as a conversion factor). The next step is to calculate the mole ratio from the given information. Then, compare the calculated ratio to the actual ratio. Use the amount of limiting reactant for calculating the amount of product produced. Lastly, if necessary, calculate how much of the non-limiting agent is left in excess. Method 2: Finding the limiting reagent by calculating and comparing the amount of product each reactant would produce. The first step is to balance the chemical equation for the given chemical reaction. Then, convert the given information into moles. Use stoichiometry for each individual reactant for finding the mass of product produced. The reactant which produces a larger amount of product would be the excess reagent. Lastly, for finding the amount of remaining excess reactant, subtract the mass of excess reagent consumed from the total mass given of the excess reagent. Limiting Reagent Problems Determine the limiting reagent if 76.4 grams of C2H3Br3 reacts with 49.1 grams of O2. $C_2H_3Br_3 + 11O_2 \rightarrow 8CO_2 + 6H_2O + 6Br_2$ Solution: Using method 1: $76.4g \times \frac{1 mol}{266.72g} = 0.286 mol C_2H_3Br_3$ $49.1g \times \frac{1 mol}{32g} = 1.53 mol O_2$ If you assume that all of the oxygen is used up, $1.53 \times 11 = 16.83 mol O_2$ are required. Since there are only 0.286 moles of C2H3Br3 that are available, C2H3Br3 is the limiting reagent here. Using method 2: $76.4g \times \frac{1 mol}{266.72g} \times \frac{11 mol O_2}{1 mol C_2H_3Br_3} = 31.1 mol O_2$ $49.1g \times \frac{1 mol}{32g} \times \frac{1 mol CO_2}{8 mol O_2} = 1.53 mol CO_2$ $49.1g \times \frac{1 mol}{32g} \times \frac{6 mol H_2O}{11 mol O_2} = 8.51 mol H_2O$ $49.1g \times \frac{1 mol}{32g} \times \frac{6 mol Br_2}{11 mol O_2} = 8.51 mol Br_2$ Hence, by using any of these methods, C2H3Br3 is the limiting reagent. In a chemical reaction, the limiting reagent (or limiting reagent) is the reactant that is used first, limiting the amount of product that can be created. There are a variety of methods for determining the limiting reagent, as we saw in the above examples, but they all rely on mole ratios from the balanced chemical equation. The theoretical yield is the amount of product that can be created depending on the limiting reactant. In fact, the actual yield, or the amount of product obtained, is usually always less than the theoretical yield. The actual yield is commonly represented as a percent yield, indicating how close the actual yield was to the theoretical yield.