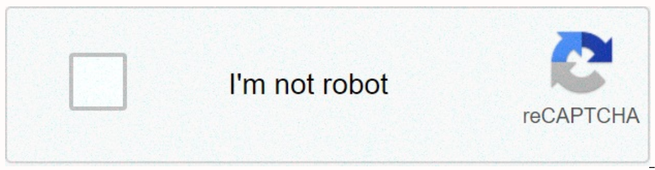

Continue

Limiting reactant problems

Take the reaction: NH3 + O2 NO + H2O. In one experiment, 3.25 g of NH3 is allowed to react with 3.50 g of O2. Insinuation to. What reagent is the limiting reagent? B. How many grams of NO are formed? c. How much of the excess reagent remains after the reaction? If 4.95 g of ethylene (C2H4) is burned with 3.25 g of oxygen. Insinuation to. What is the limiting reagent? B. How many grams of CO2 are formed? Consider the reaction of C6H6 + Br2 C6H5Br + HBr a. What is the theoretical performance of C6H5Br if 42.1 g of C6H6 react with 73.0 g of Br2? B. If the actual performance of C6H5Br is 63.6 g, what is the performance percentage? 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 produce 17.1 g of C4H9Br, what is the percentage of performance of this reaction? Hint Silicon Nitride (Si3N4) is made by a combination of si and nitrogen gas (N2) at high temperature. How much (in g) If it is needed to react with an excess of nitrogen gas to prepare 125 g of silicon nitride if the percentage of reaction performance is 95.0%? Wine insc souring occurs when ethanol is converted into acetic acid by oxygen by the following reaction: C2H5OH + O2 CH3COOH + H2O. A 1.00 L bottle of wine, labeled 8.5% ethanol (by volume), 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 water density is 1.00 g/ml. One. What oxygen mass should have leaked into the bottle? Tip b. What is the percentage of performance for converting ethanol into acetic acid if O2 is excessive? Tip A reaction vessel contains 5.77 g of P4 and 5.77 g of O2. The following reaction occurs: P4 + O2 P4O6. If enough oxygen is available, the P4O6 reacts even more: P4O6 + O2 P4O10. Insinuation to. What is the limiting reagent for the formation of P4O10? B. What mass of P4O10 is produced? c. What mass of excess reagent is left in the reaction vessel? Confirmation: If we use all chlorine then: 2 to 3 Cl2 x 0.42 mol x to 0.28 moles of aluminum are necessary. When there is not enough of a reagent in a chemical reaction, the reaction stops abruptly. To find out how much product produced, it must be determined that the reagent will limit the chemical reaction (the limiting reagent) and that the reagent is excessive (excess reagent). One way to find the limiting reagent is by calculating the amount of product that can be formed by each reagent; the one that produces the least product is the limiting reagent. The following scenario illustrates the importance of limiting reagents. To assemble a car, you need 4 tyres and 2 headlights (among others In this east imagine that tires and headlights are reactive while the car is the product formed from the reaction of 4 tyres and 2 headlights. If you have 20 tires and 14 headlights, how many cars can you make? With 20 tires, you can produce 5 cars because there are 4 tires for a car. With 14 headlights, you can build 7 cars (each car needs 2 headlights). Although more cars can be made from the available headlights, only 5 full cars are possible due to the limited number of tires available. In this case, the headlights are too much. Because the number of cars consisting of 20 tyres is less than the number of cars produced by 14 headlights, tyres are the limiting reagent (limiting the complete completion of the reaction, in which all reagents are exhausted). This scenario is illustrated below: 4 Tires + 2 Headlights 1 Car + Figure 1: The synthesis reaction of making a car. Images used from Wikipedia with permission. The initial condition is that there must be 4 tyres to 2 headlights. Therefore, reagents must be produced in that proportion; otherwise, one will limit the reaction. There are 20 tires and 14 headlights, so there are two ways to see this problem. For 20 tyres, 10 headlights are required, while for 14 headlights, 28 tyres are required. Because there are not enough tyres (20 tires is less than the required 28), tires are the limiting reagent. The limiting reagent is the reagent that is completely depleted in a reaction and therefore determines when the reaction stops. From reaction steichiometry, you can calculate the exact amount of reagent needed to react with another element. If the reagents are not mixed in the correct estechiometric proportions (as indicated in the balanced chemical equation), then one of the reagents will be completely consumed while another will be left over. The limiting reagent is the one that is fully consumed; limits the reaction of continuing because there is nothing left to react with the overreaction. There are two ways to determine the limiting reagent. One method is to find and compare the lunar relationship of the reagents used in the reaction (focus 1). Another way is to calculate the grams of products produced from the given quantities of reagents; the reagent that produces the least amount of product is the limiting reagent (focus 2). How to find the limiting reagent: Focus 1 Find the limiting reagent by looking at the number of moles in each reagent. Determine the balanced chemical equation for the chemical reaction. It converts all the given information into moles (most likely, by using molar mass as a conversion factor). Calculate the ratio of moles based on the given information. Compare the calculated with the actual relationship. Use the limiting reagent quantity to calculate the quantity of product produced. If necessary, calculate how much is above the non-limiting reagent. Limiting. to find the limiting reagent: Focus 2 Find the limiting reagent by calculating and comparing the amount of product each reagent will produce. Balance the chemical equation for the chemical reaction. Turn the given information into moles. Use sichiometry for each individual reagent to find the mass of the product produced. The reagent that produces the least amount of product is the limiting reagent. The reagent that produces the most product is excess reagent. To find the remaining amount of excess reagent, subtract the mass from the excess reagent consumed from the total mass of the given excess reagent. Example of the word :('PageIndex'{1}': Photosynthesis Consider breathing, one of the most common chemical reactions on earth. •['ce' C6H_{12}O6 + 6 O_2 'rightarrow 6 CO2 + 6 H2O' + 'rm'energy'] Which carbon dioxide mass is formed in the reaction of 25 grams of glucose with 40 grams of oxygen? Solution When addressing this problem, keep in mind that every 1 glucose mole ((C_6H_{12}O_6)) requires 6 moles of oxygen to obtain 6 moles of carbon dioxide and 6 moles of water. Step 1: Determine the balanced chemical equation for the chemical reaction. The balanced chemical equation is already given. Step 2: Convert all the given information into moles (most likely, through the use of molar mass as a conversion factor). ('mathrm'25':g''C_6H_{12}O_6'mommy-40-:g'times': mol'32':g''"1.25': mol': O_2') Step 3: Calculate the ratio of moles from the given information. Compare the calculated relationship to the actual relationship. A. If all 1.{1}{6}25 moles of oxygen were depleted, there would have to be glucose moles. There are only 0.1388 moles of glucose available which makes it the limiting reagent. [[1.25'; 'rm'mol';' O_2 of text unit times in the .dfrac file. C_6H_{12}O_6 6th; . rm-mol; O_2 0.208o; .rm-mol; C_6H_{12}O_6 number]. If all moles were depleted 0.1388 glucose, there would have to be 0.1388 x 6 or 0.8328 oxygen moles. Because there is excess oxygen, the amount of glucose is used to calculate the amount of products in the reaction. [[0.1388'; 'rm' mol'; C_6H_{12}O_6 time unit time unit time of unit unit of the unit O_2 of the C_6H_{12}O_6 of 0.8328 euros; •rm-mol; O_2 number] If more than 6 O2 moles are available per C6H12O6 mole, oxygen is excess and glucose is the limiting reagent. If less than 6 moles of oxygen are available per glucose mole, oxygen is the limiting reagent. The ratio is 6 mole oxygen per 1 mole glucose, or 1 mole oxygen per 1/6 mole glucose. This means: 6 mol O2 / 1 mol C6H12O6 . Therefore, the ratio of moles is: (0.8328 mol O2)/(0.208 mol C6H12O6) This gives a ratio of 4,004 from O2 to C6H12O6. Step 4: Use the amount of to calculate the amount of CO2 or H2O produced. Para Para dioxide produced: á('mathrm'0.1388': moles': glucose''times'dfrac'{6}{1}''0.8328': moles': carbon': dioxide'). Step 5: If necessary, calculate how much is left over. 1.25 mol - 0.8328 mol at 0.4172 moles of oxygen left over Example :('PageIndex{2}''): Magnesium oxidation Calculate the mass of magnesium oxide possible if 2.40 g (Mg) reacts with 10.0 g (O_2) ['ce' Mg +O_2 'rightarrow MgO' onumber'] Solution Step 1: Balance equation '['ce'2 Mg + O_2 'rightarrow 2' onumber'] Step 2 and Step 3: Converting masses to moles and stoichiometry . :g': Mg'times'1.00': mol': Mg'24.31':g': Mg''00': mol': Mg'':'':':') ('mathrm'10.0':g': O_2'horas''dfrac'': 'mol': O_2'32.0':g': O_2'hours':'2o: mol: mgo- 1: mol- : O_2 of application unit times: 40.31: g: mgo: mol: mgo, 25,2, : g-: MgO) Step 4: The reagent that produces a lower amount of product is the limiting reagent Mg produces less MgO than O2 (3.98 g MgO vs. 25.2 g MgO) , therefore Mg is the limiting reagent in this reaction. Step 5: The reagent that produces a higher amount of product is excess O2 reagent produces more mgo than Mg (25.2g MgO vs. 3.98 MgO), therefore O2 is the excess reagent in this reaction. Step 6: Find the remaining amount of excess reagent by subtracting the mass from the excess reagent consumed from the total mass of the given excess reagent. Mass of excess reagent calculated using the limiting reagent: . ('mathrm''2.40':g': Mg 'times'1.00': mol': Mg'24.31':g': Mg' times 'O_2':':':':•dfrac-32.0-:g-: O_2-1.00-: mol-: O_2- 1.58-:g-: O_2-) O Mass of excess reagent calculated using the mass of the product: . ('mathrm'3.98':g': MgO'times''1.00' : mol- : mgo-40.31-:g-: MgO-times of the unit of O_2: O_2 2.00: mol: mgo: O_2 unit times: O_2: 1.00o: mol: O_2: 1.58o: g: O_2) The mass of the total excess reagents given – mass of excess reagent consumed in the reaction 10.0g – 1.58g to 8.42 g of O2 is excessive. Example of ('PageIndex{3}'): Limited reagent What is the limiting reagent if 76.4 grams of the word C_2H_3Br_3 have been reacted with 49.1 grams of the word O_2) 4 C_2H_3Br_3 + 11 O_2 solution of the right arrow 8 CO_2 + 6 H_2O + 6 Br_2 onumber] Using Focus 1: A. • :g-0.286-: moles:: de- : C_2H_3Br_3) á ('mathrm'49.1': g'times': mole': mole'32':g' ' 1.53': moles': of': O_2') B. Assuming that all oxygen is depleted{4}{11} C2H3Br3 or 0.556 C2H3Br3 moles are required. Because only 0.286 C2H3Br3 moles are available, C2H3Br3 is the limiting reagent. Using Focus 2: ('mathrm'76.4':g': C_2H_3Br_3'times' ''dfrac'': 'mol': C_2H_3Br_3'266.72':g': C_2H_3Br_3'' ':'':'': 'mol':: CO_2'4': mol': mol': CO_2: CO_2: CO_2: 25.2, g: CO_2 O_2, mathrm O_2 CO_2: CO_2: O_2: O_2, 32, g, : O_2', 'times', 'dfrac'8': ': 'CO_2'11': 'mol': O_2', 'times', 'dfrac', '44.01': g': CO_2': mol': CO_2', '49,1', 'g': CO_2') Therefore , by any method, by any method, C2H3Br3 is the limiting reagent. Example of ('PageIndex{4}'): Limited reagent What is the limiting reagent if 78 grams of Na2O2 with 29.4 grams of H2O were reacted? Solution using Focus 1: A. ('mathrm':g''times'Na_2O_2' ('mathrm'29.4':g''times': 'mol''18':g'1.633': moles': of': H_2O') B. Suppose all water is consumed, 1.6{2}{2}33 or 1,633 moles na2O2 polka dots are required. Because there are only 1,001 Na2O2 moles, it is the limiting reagent. Using Focus 2: ('mathrm'78':g': Na_2O_2'times' mol': 'Na_2O_2'77.96':g': Na_2O_2'' times'' 2o: mol: Na_2O_2 Na_2O_2: sometimes adrac-40:g: NaOH-1-: mol-: NaOH- to 80.04-:g-: NaOH-) The use of any of na2O2 approaches as a limiting reagent. Example of PageIndex{5}: Excess reagent How much is the excess reagent if 24.5 grams of coo with 2.58 grams of O2 are reacted? [4 CoO + O_2 from solution A.A. to Co_2O_3 right 2 of solution A. :g': of company values: coo-) ('mathrm''2.58':g'': ':'O_2'Assuming all oxygen is depleted, Moles of 0.080{4}{1}6 or 0.3225 of the class moles are required. (CoO) . Because there are 0.327 coO moles, CoO is excessive and therefore O2 is the limiting reagent. C. 0.327mol - 0.3224mol to 0.0046 moles left too much. Example of ('PageIndex'{6}'): Identifying the limiting reagent will react completely with SiO_2 22.6 grams of the word (H_2F_2)? If not, identify the limiting reagent. [SiO_2+ 2 H_2F_2 of solution A. SiF_4 + H_2O on the right] Solution A.: moles: from: SiO_2) ('mathrm'22.6':g'times'': 'dfrac'': mole'39.8':g' ''0.568': moles': of': H_2F_2') B. There must be 1 SiO2 mole for every 2 H2F2 moles consumed. Because the ratio is 0.478 to 0.568, 28.7 grams of SiO2 do not react with H2F2. C. Assuming that all silicon dioxide is depleted{2}{1}, H2F2 moles are required (. Because there are only 0.568 moles of H2F2, it is the limiting reagent. Reagent.