

Limiting Legos © - ANSWER KEY

Data Table

Part	# Product Molecules	Excess Reactant	Limiting Reactant
1	6 H ₂ O	4 Oxygen	Hydrogen
2	5 H ₂ O	7 Oxygen	Hydrogen
3	4 H ₂ O	2 Hydrogen	Oxygen
4	4 NH ₃	2 Nitrogen	Hydrogen
5	4 NH ₃	None	None

Questions

1. How many molecules of water could be made in Part 1? Explain.

Only 6 molecules of water could be made in part 1. Only 6 molecules of hydrogen (12 atoms) were available and each water molecules requires 2 Hydrogen. Therefore, hydrogen ran out first.

2. How many molecules of water could be made in Part 2? Explain why it is different than Part 1.

Only 5 molecules of water would be made in part 2. This is different than part 1 because there was less hydrogen to start with.

3. After reviewing the results of the experiment in Parts 1-3, is the smallest number of moles always equal to the limiting factor? Explain.

The smallest number of molecules is not the limiting reactant. It depends on how much of each reactant is needed to create the products.

4. Explain how there can be less of the N₂ than H₂ to start with, but there is some N₂ left over after the reaction.

The reason nitrogen was left over is because of the chemical formula – NH₃. 3 Hydrogens are needed for every 1 nitrogen; thus, the hydrogen runs out much faster. Since the hydrogen runs out 3 times faster than the nitrogen, the nitrogen may be the excess reactant even if there is less available to start with.

5. Which “ingredient”, the limiting factor or the excess, determines the amount of product that can be made?

The limiting reactant determines the amount of product that can be made.

6. What is different about Part 5 from the others in this experiment?

In part 5, all the reactants were used up. There was no excess or limiting reactant.

7. Can a conclusion be made that there will never be “leftovers” if the moles of the givens are in the same ratio as the balanced equation coefficients? Explain.

*The conclusion that can be made is that there will be no leftovers is the ration of the atoms in the reactant(s) is the same as the ratio of the atoms in the product(s). This is **stoichiometric quantities** - quantities of reactants mixed in exactly the correct amounts so that all are used up at the same time.*