Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period \_\_\_\_\_\_

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| **Sandwich Stoichiometry** |

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| **Your Tasks (Mark these off as you go)** |
| * Explore stoichiometry sandwiches * Explore the stoichiometry of chemical reactions * Test your understanding * Receive credit for this lab |

* + **Explore stoichiometry sandwiches**

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| **Part 1. Cheese Sandwiches** | |
| Go to the PhET simulation website:  <https://phet.colorado.edu/sims/html/reactants-products-and-leftovers/latest/reactants-products-and-leftovers_en.html>  And select “Sandwiches” |  |
| Make sure the “Cheese” option is selected |  |
| Use the arrows to enter the following under the reactants on the left (“Before Reaction”):  **Before Reaction**  8 pieces of bread  8 pieces of cheese  Record the amounts of products, and the amounts of leftovers in the Part 1 Data Table below. |  |
| Complete Part 1 Data Table for the amounts indicated. | |  |  | | --- | --- | | **Reactants** | | |  |  | | 8 | 8 | | 5 | 8 | | 4 | 8 | | 6 | 3 | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part 1 Data Table: Cheese Sandwiches** | | | | |
| **Reactants** | | **Products** | **Leftovers** | |
|  |  |  |  |  |
| 8 | 8 |  |  |  |
| 5 | 8 |  |  |  |
| 4 | 8 |  |  |  |
| 6 | 3 |  |  |  |

|  |
| --- |
| For which conditions were there no leftovers? What is ratio of bread to cheese for this condition? |
|  |
| Based on the ratio above, write balanced reaction for making cheese sandwiches. |
|  |

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| --- | --- |
| **Part 1. Meat & Cheese Sandwiches** | |
| Select “Meat and Cheese” at the top |  |
| Use the arrows to enter the following under the reactants on the left (“Before Reaction”):  **Before Reaction**  5 pieces of bread  5 pieces of meat  5 pieces of cheese  Record the amounts of products, and the amounts of leftovers in the Part 2 Data Table below. |  |
| Complete Part 2 Data Table for the amounts indicated. |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Part 2 Data Table: Meat & Cheese Sandwiches** | | | | | | |
| **Reactants** | | |  | **Leftovers** | | |
|  |  |  |  |  |  |  |
| 5 | 5 | 5 |  |  |  |  |
| 8 | 3 | 4 |  |  |  |  |
| 8 | 4 | 4 |  |  |  |  |
| 3 | 2 | 1 |  |  |  |  |

|  |
| --- |
| For which conditions were there no leftovers? What is ratio of bread to cheese to meat for this condition? |
|  |
| Based on the ratio above, write balanced reaction for making meat & cheese sandwiches. |
|  |

* + **Explore the stoichiometry of chemical reactions**

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| --- | --- |
| **Part 1. Stoichiometry of making water** | |
| Select the “Molecules” option at the bottom of the page. |  |
| Select the “Make Water” option. |  |
| Use the arrows to enter the following under the reactants on the left (“Before Reaction”):  **Before Reaction**  6 H2  4 O2  Record the amounts of products, and the amounts of leftovers in the Part 1 Data Table below. |  |
| Complete Part 1 Data Table for the amounts indicated. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part 1 Data Table: Stoichiometry of water** | | | | |
| **Reactants** | | **Products** | **Leftovers** | |
| H2 | O2 | H2O | H2 | O2 |
| 8 | 8 |  |  |  |
| 5 | 8 |  |  |  |
| 4 | 8 |  |  |  |
| 6 | 3 |  |  |  |

|  |
| --- |
| For which conditions were there no leftovers? What is ratio of hydrogen to oxygen for this condition? |
|  |
| Based on the ratio above, write balanced reaction for making water. |
|  |
| How much hydrogen and oxygen is needed to make exactly 4 water molecules with no leftovers? |
|  |

|  |  |
| --- | --- |
| **Part 2. Stoichiometry of making ammonia** | |
| Select the “Make Ammonia” option. |  |
| Use the arrows to enter the following under the reactants on the left (“Before Reaction”):  **Before Reaction**  5 N2  5 H2  Record the amounts of products, and the amounts of leftovers in the Part 2 Data Table below. |  |
| Complete Part 2 Data Table for the amounts indicated. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part 2 Data Table: Stoichiometry of ammonia** | | | | |
| **Reactants** | | **Products** | **Leftovers (Excess)** | |
| N2 | H2 | NH3 | N2 | H2 |
| 5 | 5 |  |  |  |
| 6 | 3 |  |  |  |
| 3 | 6 |  |  |  |
| 2 | 6 |  |  |  |

|  |
| --- |
| For which conditions were there no leftovers? What is ratio of nitrogen to hydrogen for this condition? |
|  |
| Based on the ratio above, write balanced reaction for making ammonia |
|  |
| How much nitrogen and hydrogen is needed to make exactly 2 ammonia molecules with no leftovers? |
|  |

|  |  |
| --- | --- |
| **Part 3. Stoichiometry of the combustion of methane** | |
| Select the “Combust Methane” option. |  |
| Use the arrows to enter the following under the reactants on the left (“Before Reaction”):  **Before Reaction**  6 CH4  6 O2  Record the amounts of products, and the amounts of leftovers in the Part 3 Data Table below. |  |
| Complete Part 3 Data Table for the amounts indicated. |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Part 3 Data Table: Stoichiometry of the combustion of methane** | | | | | |
| **Reactants** | | **Products** | | **Leftovers (Excess)** | |
| CH4 | O2 | CO2 | H2O | CH4 | O2 |
| 6 | 6 |  |  |  |  |
| 6 | 4 |  |  |  |  |
| 2 | 4 |  |  |  |  |
| 3 | 7 |  |  |  |  |

* + **Test your understanding**

|  |  |
| --- | --- |
| Navigate to the Build an Atom game  <https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html> |  |
| Play levels 1, 2, and 3. Once you have completed all four levels, take a screenshot of your results and paste it below. |  |

|  |
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| Paste a screenshot of your game results below. |
|  |

* + **Receive Credit for this lab**

Each group member must complete and submit their own lab to receive credit