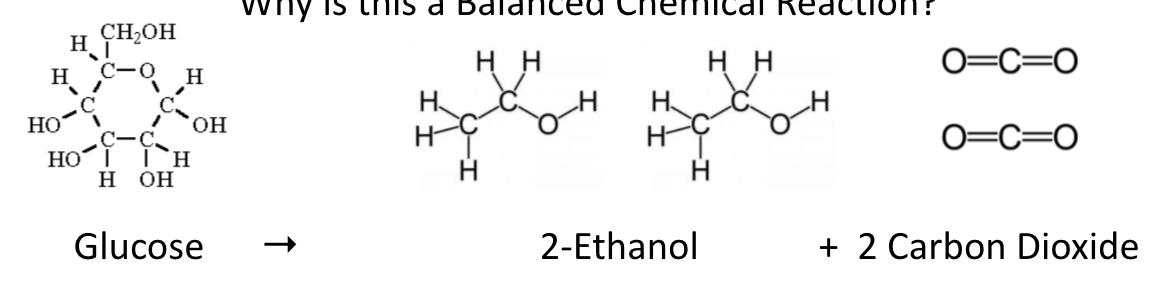
Yellow Biotechnology

Did you know that yeast is a domesticated living organism? We use yeast’s ability to perform alcoholic fermentation to produce food and drinks daily. Using microorganisms like yeast to engineer and manufacture edible products is known as **Yellow Biotechnology**.

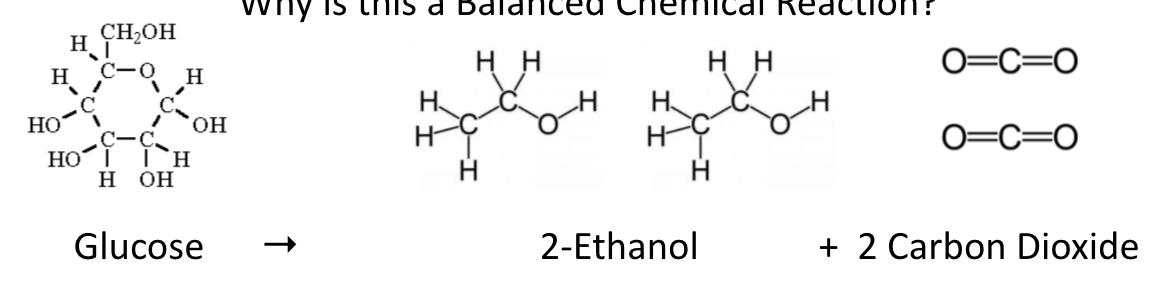
|  |
| --- |
| **Facts from “Here’s Everything You Need to Know about Yeast.”** |
|  |

When manufacturing our products with yeast (which are living organisms/cells) it is essential that we engineer the best working conditions for the yeast but get the best yield of products from the yeast.  
 **Reactants**                                                                       **Products**

|  |
| --- |
| **What do you think would happen if we increased the amount of glucose reactant we give the yeast?** |
|  |
| **What do you think could happen to the yeast cells if we expose them to too much glucose reactant?** |
|  |

Engineering the Efficiency of Alcoholic Fermentation

Problem: How can we produce the MAX amount of CO2?



**REACTANTS** **PRODUCTS**

Other Reactants:

|  |  |  |
| --- | --- | --- |
| **Glucose** | **Fructose** | **Starch** |
| https://lh5.googleusercontent.com/_GxhSYlYWmSXmVb0J0D3SXmVBelYNbyWiCLVNII3zk0fjxN58O1mStF8c3JUy3GEKXAaX2z4Hg75r_tkK8W7qCgv8iPmWvMj2tLJ1y2BKB-Ia9ItpYumheBIksIaER29VS4YBHiG | https://lh5.googleusercontent.com/sk_Cmy-cR8aVIR68YxeDTaufZYmqxcksH5B23o_werhPkRa3mPNecu7k_2iuqHhTOYv246cHUVFFAS6bznefe3DDK1Tlr3942z_-bFY8rbYHqxt5k7KhWIDNQENv--xNzLiDF7H- | https://lh5.googleusercontent.com/FlNC0eKGVIrQX1mXZ0hw2PEEa3mr3PjXJL9hUAspfm4RK0g5ge21g4ESq12OtDBs7GX-EP3nRa7g6px2Gh75lK3MMENEN7cZtgRmRZTJZ-dlTwVt333yMJtkU2Xe61ukRXGO9xmy |
|  |  |  |

|  |  |
| --- | --- |
| **Lactose** | **Sucrose** |
| https://lh6.googleusercontent.com/k-16qsyNe625Y41CZsRjB6VXdor85Kvc6ZvLRqDiYUWR-yR6h0Rr4STv9M4Qm_vZ86no1GS9Y8h9mGGmpG7EIvsEHpnWWA7H8_3SzIyR5or-2__kwVmuy9l8Ao-8UpUpOCTzc8NJ | https://lh6.googleusercontent.com/MWHrACPxXXMUwccj8iMDJBfJ4WcKgzmClMhCbj8JAuA76sSX_SBZtLTdY7BnPlWK7Fc1q5fxzVr2fQe4au25ydUw6fECx0PcwUM22Tp6xSG7_3jK2dX8oWbpqmdk8XJwwca8yWeK |
|  |  |

|  |
| --- |
| **If we changed the reactant from glucose to fructose, what do you think would happen to the amount of CO2 produced? Why?** |
|  |
| **If we changed the reactant from glucose to lactose, what do you think would happen to the amount of CO2 produced? Why?** |
|  |
| **If we increased the amount of glucose reactant, what do you think would happen to the amount of CO2 produced? Why?** |
|  |
| **Hypothesis 1 (Reactant Hypothesis) How will different reactants affect product production of CO2?** |
|  |
| **Hypothesis 2 (Reactant Concentration Hypothesis) How will reactant concentration affect product production of CO2?** |
|  |

|  |
| --- |
| **The Closed System Set-up and Water Displacement Apparatus** |
| Group Assigned Reactant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample 1** | **Sample 2** | **Sample 3** | **Sample 4** |
| Balloon color | Balloon color | Balloon color | Balloon color |
| 2g of yeast  2g of reactant  30mL of water | 2g of yeast  3g of reactant  30mL of water | 2g of yeast  4g of reactant  30mL of water | 2g of yeast  5g of reactant  30mL of water |
| Student name | Student name | Student name | Student name |

|  |
| --- |
| **Procedure** |
| 1. Place balloon on a funnel \*\*Make sure when loading your balloon that you hold both the neck of the   balloon and funnel to prevent the balloon from falling off of the funnel. |
| 1. Into the balloon add 2.0g of yeast |
| 1. In the same balloon add your assigned amount of reactant |
| 1. Assemble the water displacement apparatus according to teacher instructions |
| 1. In the same balloon add 30mL of 40C water |
| 1. Carefully remove the funnel from the balloon |
| 1. With the help of a partner, stretch the neck of the balloon and seal the opening with a string tied in a   knot. |
| 1. Cut the excess string and be careful to not pierce the balloon! |
| 1. Shake the balloon 10 times \*\*Optional: Take a before picture of your balloon. |
| 1. Place the balloon in the water displacement apparatus |
| 1. Place the foam plate on top of the balloon in the apparatus, and a bag of rice on top of the plate.   This will hold the balloon under the water as it expands with CO2. |
| 1. Record the balloon’s start volume. Set a timer set for 2 minutes |
| 1. Record the balloon’s volume every 2 minutes for 40 minutes |
| 1. After 40mins, remove the balloon from the water displacement apparatus. |
| 1. Take a final picture of your sample. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time (min)** | **2g of Reactant** | **3g of Reactant** | **4g of Reactant** | **5g of Reactant** |
| 0 START |  |  |  |  |
| 2 |  |  |  |  |
| 4 |  |  |  |  |
| 6 |  |  |  |  |
| 8 |  |  |  |  |
| 10 |  |  |  |  |
| 12 |  |  |  |  |
| 14 |  |  |  |  |
| 16 |  |  |  |  |
| 18 |  |  |  |  |
| 20 |  |  |  |  |
| 22 |  |  |  |  |
| 24 |  |  |  |  |
| 26 |  |  |  |  |
| 28 |  |  |  |  |
| 30 |  |  |  |  |
| 32 |  |  |  |  |
| 34 |  |  |  |  |
| 36 |  |  |  |  |
| 38 |  |  |  |  |
| 40 |  |  |  |  |

|  |
| --- |
| **Graphing Using Excel** |
| 1. Click on the tab that is labeled with your reactant name:   C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (43)_LI.jpg |
| ONLY TYPE IN THE YELLOW PORTIONS |
| 1. Type in you and your classmates names |
| 1. Type in your reactant name |
| 1. Type in your collected data from your Data Table Handout under the designated grams of reactant.   C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (44)_LI.jpg |
| 1. Scroll down and select the data below in the 2nd color (NOT YELLOW), Click on the Insert Tab, Click   On the Line Graph Icon, Click on More Line Charts.  C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (46)_LI.jpg |
| 1. Make sure to select the line graph option that does not chart Time on a line   C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (47).png |
| 1. Click on the X. Make sure the following is selected: Axes, Axis Titles, Chart Title, Gridlines, Legend   C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (49)_LI.jpg |
| 1. Select where it says, “Chart Title” and two “Axis Titles,” and give them proper names.   C:\Users\jamie.sorrell\Pictures\Screenshots\Screenshot (51)_LI.jpg |

|  |
| --- |
| **Poster Presentation Requirements (Poster MUST include the following)** |
| 1. Title |
| 1. The reaction scheme with your specific reactant and products |
| 1. Drawing of the reactant |
| 1. Hypotheses |
| 1. Table of how the samples were different |
| 1. Visual of testing apparatus |
| 1. Before and after pictures of all 4 samples |
| 1. Group graph and class graph |

|  |
| --- |
| **Verbal Presentation Requirements**  **(Verbal presentation MUST cover the following AND all students MUST participate in the presentation)** |
| 1. What is the purpose of the experiment? |
| 1. What were your hypotheses and your reasoning behind your hypotheses? |
| 1. How were your samples different? |
| 1. How were your samples tested? |
| 1. What were you testing/ What were you measuring and why? |
| 1. Using your group graph, what were the results of your group’s samples? |
| 1. Using your class graph, how did your results compare with the entire class? |
| 1. Using both graphs, were your hypotheses correct? Explain. |
| 1. If you were given an opportunity to move forward with the experiment, what would you do next and   why? Explain. |