Yeast Growth Challenge

Objective: To use a simple living thing and its natural food processing pathways to produce the maximum amount of carbon dioxide in a fixed period of time. The optimal growth conditions will be pre-determined by the students and the amount of carbon dioxide produced will be measured on site.

Purpose:

-To encourage research on food processing, glycolysis, fermentation, and other related processes.
-To understand and learn to culture microorganisms in liquid media.
-To measure the production of carbon dioxide by fermenting microorganisms.
-To research and improve the conditions of the culture in order to enhance fermentation.

Means:

Individuals or teams of students will have to determine what culture medium and substrates are the best to maximize fermentation in baker's yeast. Following the rules, the students will have to determine which growth conditions are the most effective and efficient.

Rules:

-The microorganism to be used is common baker's yeast: Saccharomyces cerevisiae. It will be provided on site. Each team will be provided with the same amount of yeast (approx. 5 – 10 g).
-Media materials (water and organic and/or inorganic materials) will be provided by the students. It is suggested that the water used be ddH_2O (double-distilled or double-deionized water) which is available from drug stores or through a chemical supply company.
-Containers (flasks or beakers) will be provided on site and will have a volume of approx. 500 mL.
-The volume of liquid medium plus living cells should not exceed 350 mL. The official amount will be set at the competition.
-The best culture medium is to be determined by the students.
-The optimal growth conditions (ingredient ratios, temperature, pressure, pH, etc…) are to be determined by the students.
-Electricity and outlets will be provided on site. Students bring extension cords as needed.

-A notebook is required for each project. If working as a team, each student may use his/her own notebook, or they may use a single notebook. The notebooks are for the team members to enter their ideas, research information and sources, experimentation procedures and data, graphs, analyses, and conclusions. Once an entry is made, it is not destroyed. An incorrect entry will be crossed out with a single line, and followed by a corrected entry. For more specifics on how the entries are to be made, go to Home Page > For Students > Resources > Keeping an Experimental Notebook.

-At the end of the project, details from the notebook(s) will be extracted and combined to make a single presentation on the display poster. All of the notebooks are required to be at the display. A summary sheet of notebook contents can be placed on top of each notebook to assist judge review.

Competition:

The objective is to get the best carbon dioxide production within a one hour period. The measurement will be done on site, using a CO_2-Vernier probe, which will be inserted into the culture medium. For each team, the concentration difference between time zero and 60 minutes will be kept on file and will

be used to calculate the competition scores. The experimental flask will have its concentration compared at time zero and time 60 minutes, and the concentration at both times will be compared with that of a control flask.

The containers, yeast,, and Vernier probes for measuring CO_2 will be provided on site. Students will provide their own media. One container will be used for control, and will contain just the media. One other container will be used for the experiment. It will have the yeast added to the media. Students will also be able to vary the ambient pressure and/or the temperature, but must do so for both their experimental flask and for the control flask.

The change in CO_2 concentration will be measured for both the experimental flask and the control flask. The control flask contains no yeast, so any change is independent of that. After one hour, the change in CO_2 concentration in the control flask will be subtracted from the change of concentration in the experimental flask. That difference is due to student efforts and will be their competition score.

Scoring:
There are two parts. The first part is the actual competition where the CO_2 concentrations are measured, recorded, and compared. The second part is where the judges interview the students.

Scoring the competition: (70 points)
Experimental Difference = Final Reading of experimental flask – Initial Reading of experimental flask

= ( ) – ( ) = (_____)

Control Difference = Final Reading of control flask – Initial Reading of control flask

= ( ) – ( ) = (_____)

Growth Difference = (Experimental Diff) – (Control Difference) = _____

Team Score = $\frac{\text{This Growth Difference}}{\text{Largest Growth Difference}} \times 70 = \frac{(\quad)}{(\quad)} \times 70 =$ _____

Interview scoring: (30 points)

Scoring of the Poster Board, Notebook, and Interview:

Description	Good/Fair/Poor	Points possible	Points earned
Scoring for Poster and Display will consider the following:		10	
1. Display is within size limitations;	1. Good/Fair/Poor		
2. Poster shows title and the objective at the top	2. Good/Fair/Poor		
3. Display is neat, organized & appealing;	3. Good/Fair/Poor		
4. Spelling and sentence structure are correct	4. Good/Fair/Poor		
5. Reasonable prediction of how well they would do	5. Good/Fair/Poor		
6. Team described other approaches they could have used, or other areas they could have investigated.	6. Good/Fair/Poor		

Scoring for Notebook, will consider the following: 1. Notebooks indicate scientific approach 2. Includes bibliography of references 3. Data is recorded well 4. Each day of entries dated and initialed	 1. Good/Fair/Poor 2. Good/Fair/Poor 3. Good/Fair/Poor 4. Good/Fair/Poor	10	
Scoring for Interview, will consider the following: 1. Quality of answers to the judges' questions; 2. Understanding of key parts of the challenge, and the underlying science. 3. All participants are knowledgeable and understand the project	 1. Good/Fair/Poor 2. Good/Fair/Poor 3. Good/Fair/Poor	10	
	Total	30	

Overall Scoring of the Event: (100 points)

(Competition Score) + (Poster, Notebook, and Interview Score)

= ( ) + ( ) = _____