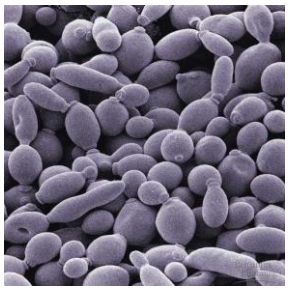
THE LIFE OF YEAST

How much do you know about fermentation?

Mr. Walker has bought a new factory to start producing ethanol. The factory has several types of rooms and as Mr. Walker does not want to pay a lot of money for reconstruction, so he needs to find out which room is the best for fermentation process. Room U.1, in the basement below ground level, has permanent low temperature (0-5 °C); room 1.1, on the first floor, is usually 15-20 °C; on the same floor there is a room 1.7 above the gas boiler, which is from the boiler heated up to 35-40 °C. Mr. Walker also believes that satisfied employees are loyal to company and contribute to better quality of product, so recently he has had large sauna built (room 0.A). This sauna keeps temperature 65-75 °C when in operation, so Mr. Walker considers whether to use it for fermentation as well.

Help Mr. Walker to find out which room is the best for the most efficient production of ethanol.



What you might need to know

Ethanol can be produced with help of yeasts that need some fundamental material to produce ethanol. The raw material is usually carbohydrates (sugars). Yeasts as well as any other organisms need optimal conditions for its life and in case of yeast also for ethanol production.

The chemical equation of the reaction in yeast is: $C_{12}H_{22}O_{11} + H_2O \rightarrow 4\ CH_3CH_2OH + 4\ CO_2$

1. Calculate how many grams of ethanol results from 10 g of sucrose (saccharose)?

2. How can be indicated that the reaction proceeds?

_____

_____

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Before you go to laboratory

1. Think about what is the variable that will affect the efficiency of ethanol production.

   _____

2. You can use the pressure sensor, carbon dioxide and temperature sensor to monitor the reaction. What do you think: what is the use of each sensor?

   Pressure sensor: _____

   CO_2 sensor: _____

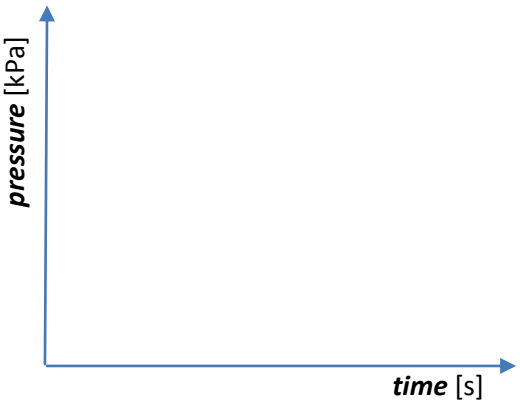
   Temperature sensor: _____

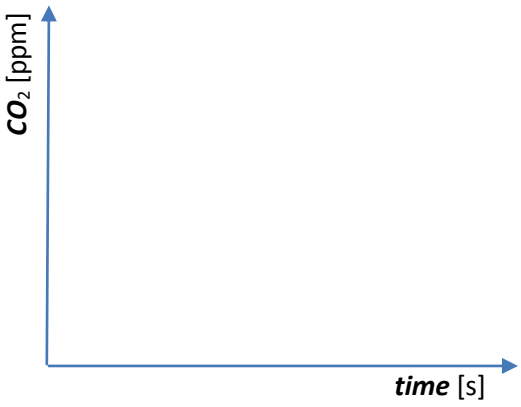
3. How can we simulate factory condition in our laboratory?

   Design your own experiment and write down its main aspects. The experiment should allow you to decide what room is the best for ethanol production. Prepare the experiment so that the actual measurement for each temperature takes no longer than 10 minutes (time is money …).

   _____
   _____
   _____

4. Make a prediction about acquired data: what does the graph look like when measuring pressure dependent on time and carbon dioxide concentration on time?





Explore the world around: simulate the process in laboratory

Hint: place the results (curves) for all the measurements in one chart to see the differences

Perform designed experiment and write down the procedure (what was exactly done):

_____
_____
_____
_____
_____
_____
_____

Evaluate the data

1. Evaluate measured data: how will you asses the efficiency of the process in each room considered for ethanol production?

   _____

2. Choose suitable and illustrative way how to present results (graph?, table?, text?)

3. Describe and explain the measured data (= interpret results):

   _____
   _____
   _____
   _____

Conclusion:

_____
_____
_____

Show your results

Write an email to Mr. Walker where you recommend him the most efficient room for ethanol production. Give him the arguments and proofs with your evaluated data to support your conclusion. Argument why are the other rooms inappropriate.

_____
_____
_____
_____
_____
_____
_____
_____

Now, you have enough of experience and knowledge to answer the following questions:

1. What is the function of yeast in whole process?

   _____

2. What is the difference between yeast and block of fresh yeast?

   _____