Cellular Respiration Lab Report

General Concepts

1. What are the commercial products produced by fermentation or anaerobic respiration? List at least two.

2. What is the purpose of respiration?

3. What are the differences between anaerobic and aerobic respiration?

4. Why do disaccharides produce more CO_2 than monosaccharides?

Experiment-Specific Questions

Digestion of Individual Sugars by Yeast Cells

1. For each of the sugars fermented by yeast, fill in the chart below to determine CO_2 production?

Results Table			
Sugar	**Initial Gas Volume t=0 minutes (mL)**	**Final Gas Volume t=5 minutes (mL)**	**Volume of CO_2 produced Final - Initial (mL)**
Glucose	**.1mL**	**21.6mL**	**21.5mL**
Fructose	**.0mL**	**7.8mL**	**7.8mL**
Maltose	**.3ml**	**24.4mL**	**24.1mL**
Maltotriose	**.0mL**	**5.0mL**	**5.0mL**

2. For each of the sugars fermented by yeast, fill in the chart below to determine the mg of sugar consumed per minute during fermentation.
   - For column one use

     $n = (P \times V) \div (R \times T)$

   - to calculate the moles of CO_2 produced
   - Use

     moles of sugar consumed = moles of CO_2 produced ÷ (2 × number of simple sugars in that sugar)

   - to calculate the moles of sugar consumed

3.

- Use

mg of sugar per minute = (moles sugar) × (MW g/mole) × (1000 mg/g) ÷ (5 minutes)

- to calculate the mg of sugar fermented per minute

Calculations Table			
Sugar	**Moles of CO_2 produced**	**Moles of Sugar Consumed**	**Mg of sugar/min**

4. Based on your results, which sugars should be provided to yeast grown commercially to minimize the amount of sugar that needs to be purchased?

I need a little help if someone has the time. I am doing a Biology Lab in Late Nite Labs and I do not understand this. Maybe someone could help me out.

Here is the questions/formulas

Experiment 1 - Fermentation of Different Sugars

For each of the sugars fermented by yeast, record the following data for CO2 production:

(a) name of the sugar
(b) initial gas volume at t=0 minutes (mL)
(c) final gas volume at t=5 minutes (mL)
(d) volume of CO2 produced (mL)
(e) temperature in the flask (deg C)

Add to your data the amount of mg of sugar consumed during fermentation. To calculate this, we need to use the ideal gas law and the equation for the chemical reaction that produces CO2 gas from sugar molecules.

Here's how to calculate it:

1. In the background to this experiment, the fermentation reaction is given:

C6H12O6 --> 2CH3CH2OH + 2CO2 + energy

The coefficients in front of the molecules tell us in what ratio reactants are used and products are produced. In this case, 2 CO2 molecules are created for every glucose molecule consumed.

Remember that the sugars tested in this experiment are either monosaccharides, disaccharides or trisaccharides, meaning that they are composed of 1,2 or 3 simple sugar molecules such as glucose and fructose, both of which have the molecular formula C6H12O6.

Therefore, the relationship between CO2 gas produced to sugar consumed can be written as:

number of CO2 molecules =

2 * (number of sugar molecules) * (number of simple sugars in that sugar)

This means that for:

a monosaccharide, 2 CO_2 molecules are produced per molecule of sugar

a disaccharide, 4 CO_2 molecules are produced per molecule of sugar

a trisaccharide, 6 CO_2 molecules are produced per molecule of sugar.

2. The next step is a little more complicated and it uses the Ideal Gas Law to convert volume of gas to molecules. To simplify the calculation, we use the mole as our unit number of molecules and the molecular weight of each sugar.

The ideal gas law relates the moles of CO_2 gas molecules to its volume by:

n = (P * V) / (R * T)

where
n is the number of moles of CO_2
R is the gas constant 0.082 L-atm/mole-Kelvin
T is temperature in Kelvin (equal to degrees Celsius + 273)
V is the volume in liters (divide the mL by 1000)
P is the atmospheric pressure in the lab, which is just 1 atmosphere (atm)

3. Once you have the moles of CO_2 produced, you use the ratio of CO_2 to sugar molecules to calculate the moles of sugar that were broken down.

4. Finally, you can express your results in units of milligrams of sugar fermented per minute. For this you need a table of the molecular weights (MW = grams/mole) of each sugar in order to convert from moles to grams.

The formula is:

mg of sugar per minute =
(moles sugar) * (MW g/mole) * (1000 mg/g) / (5 minutes)

Now, next to your data for the volume of CO_2 gas produced during each fermentation test with yeast, add the following values:

(a) Moles of CO_2 collected
(b) Ratio of (CO_2 molecules produced) to (sugar molecules broken down)
(c) Moles of sugar broken down in five minutes
(d) mg of sugar fermented per minute

Here are the Molecular Weights (MW) for the sugars tested:

Glucose = 180.2 g/mole
Fructose = 180.2 g/mole
Sucrose = 342.3 g/mole
Maltose = 342.3 g/mole
Maltotriose = 504.4 g/mole

This is what I came up with while doing the lab.

Experiment 1 - Digestion of Individual Sugars by Yeast Cells

Flask 1
50mL Glucose
50mL Yeast
Temp-2825C
Volume of Gas-.1ml   5 min 21.6ml

Flask 2
50mL Fructoes
50mL Yeast
Temp-23.6C
Volume of Gas-.0ml 5 min 7.8ml

Flask 4
50mL Maltose
50mL Yeast
Temp-29.4C
Volume of Gas-.3ml 5 min 24.4ml

Flask 5
50mL Maltotriose
50mL Yeast
Temp-27.9C
Volume of Gas .0ml 5 min 5.0ml