

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 CO₂ 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 CO₂ 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.

- o For column one use

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

- o to calculate the moles of CO₂ produced
- o Use

$$\text{moles of sugar consumed} = \text{moles of CO}_2 \text{ produced} \div (2 \times \text{number of simple sugars in that sugar})$$

- o to calculate the moles of sugar consumed

3.

- Use

$$\text{mg of sugar per minute} = (\text{moles sugar}) \times (\text{MW g/mole}) \times (1000 \text{ mg/g}) \div (5 \text{ minutes})$$

- 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

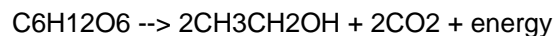
For each of the sugars fermented by yeast, record the following data for CO₂ production:

- name of the sugar
- initial gas volume at t=0 minutes (mL)
- final gas volume at t=5 minutes (mL)
- volume of CO₂ produced (mL)
- 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:

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



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 =

$2 * (\text{number of sugar molecules}) * (\text{number of simple sugars in that sugar})$

This means that for:

a monosaccharide, 2 CO₂ molecules are produced per molecule of sugar

a disaccharide, 4 CO₂ molecules are produced per molecule of sugar

a trisaccharide, 6 CO₂ 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 CO₂ gas molecules to its volume by:

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

where

n is the number of moles of CO₂

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 CO₂ produced, you use the ratio of CO₂ 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:

$$\text{mg of sugar per minute} = (\text{moles sugar}) * (\text{MW g/mole}) * (1000 \text{ mg/g}) / (5 \text{ minutes})$$

Now, next to your data for the volume of CO₂ gas produced during each fermentation test with yeast, add the following values:

- (a) Moles of CO₂ collected
- (b) Ratio of (CO₂ 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-28.25C
Volume of Gas-.1ml 5 min 21.6ml

Flask 2
50mL Fructose
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