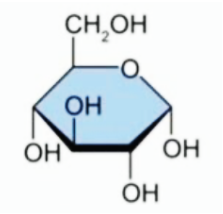
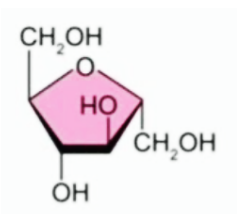
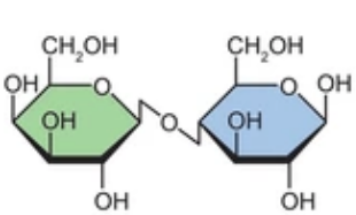
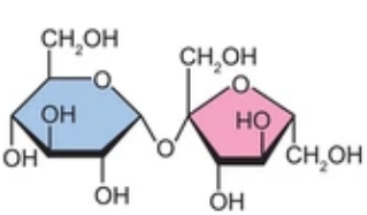
YEAST RESPIRATION

Introduction

All living systems respire. During respiration, food – usually in the form of glucose – is digested. One of the products of cell respiration is carbon dioxide. The amount of carbon dioxide released during respiration indicates the respiration rate. Respirometers that measure variations in carbon dioxide production can be constructed from commonly available science equipment and measure the quantitative rate of bubbling (CO_2 gas). Respiration rate may be influenced by a variety of factors – including temperature, substrate concentrations and the type of sugar being digested.

Aim

To investigate the effect of different types of sugars (glucose, fructose, lactose, sucrose) on the rate of respiration in yeast – as measured by the number of bubbles produced over 10 minutes.

Types of Sugars			
			
Glucose	**Fructose**	**Lactose** *(glucose + galactose)*	**Sucrose** *(glucose + fructose)*

Hypothesis

Based on your knowledge of the different types of sugars, predict their comparative effects on the respiration rate of yeast cells (i.e. faster or slower rate and suggested reason as to why it occurs).

Note: In this experiment, the concentration of the sugar solutions will be kept constant (e.g. 20%). Lactose is commonly found in milk, while sucrose is found in fruit juices and sports drinks.

Materials

- Yeast cakes (×4)
- Glucose (12 ml)
- Tall beaker
- Stoppers (×4)
- Fructose (12 ml)
- Markers
- Droppers (×4)
- Lactose (12 ml)
- Water (warm)
- Test Tubes (×4)
- Sucrose (12 ml)
- Stopwatch

Methodology

1. Insert a dropper into a rubber stopper so that it provides an air passage through the stopper.
2. Add 12 ml of each sugar solution to separate test tubes (glucose, fructose, lactose, sucrose).
3. Add a yeast cake to each test tube and mix well so that the yeast becomes fully dissolved.
4. Add the stopper with a dropper to each test tube – making sure that all tubes are tightly sealed.
5. Be sure that the ends of the droppers are not submerged in the yeast / sugar solutions.
6. Place the test tubes into a tall beaker filled with warm water (test tubes must be submerged).
7. Allow tubes to sit undisturbed for no less than 5 minutes (see figure 1 for experimental setup).
8. Count the number of bubbles rising from the stopper each minute for ten minutes.

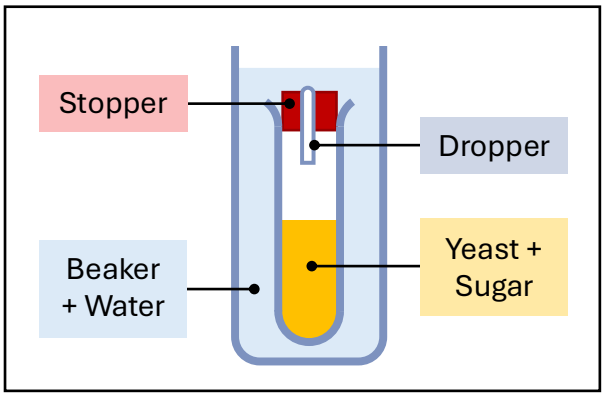


Figure 1: Diagram of Experimental Setup

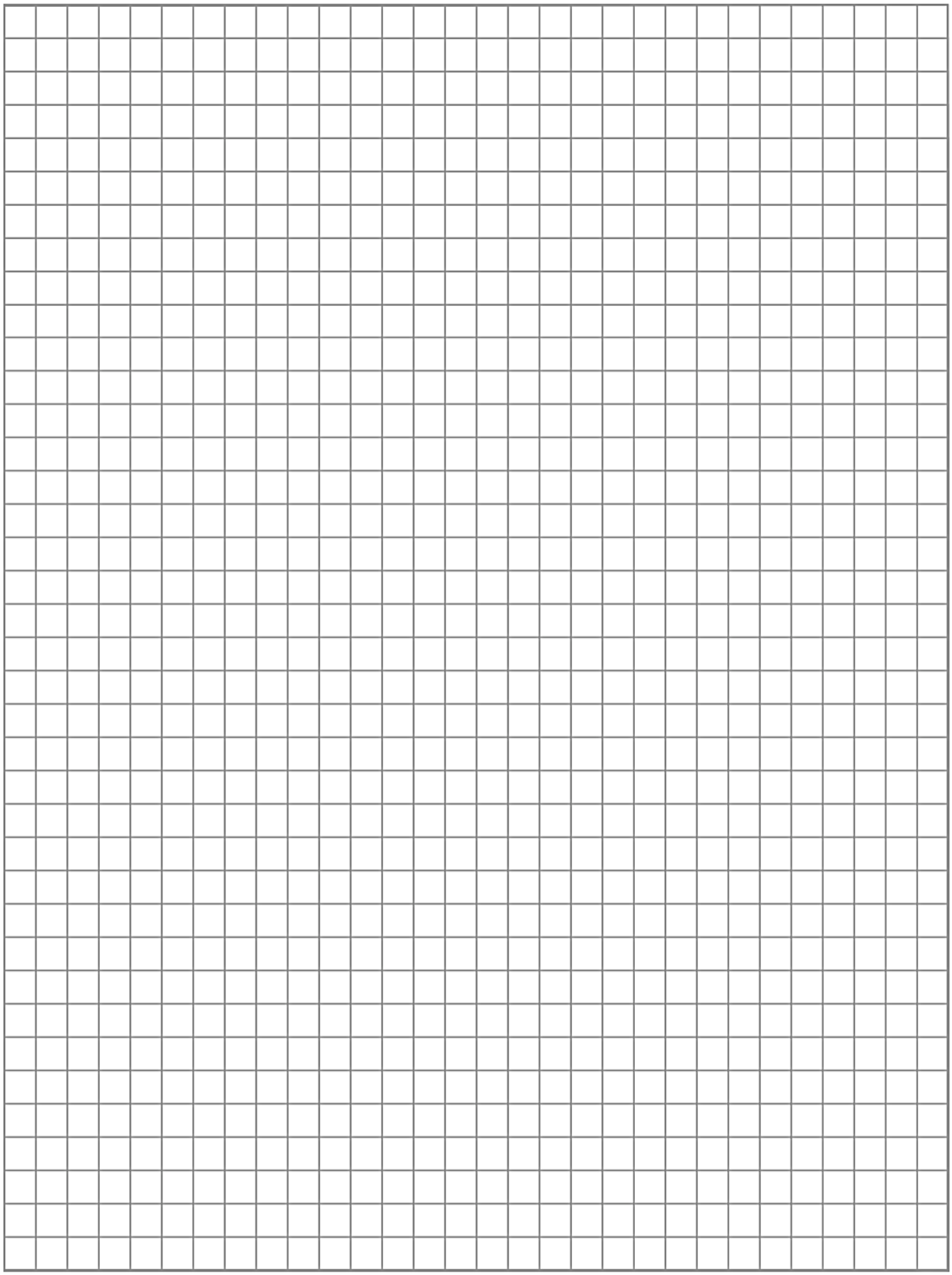
- It is important to let the tube sit undisturbed for 5 minutes to allow the carbon dioxide to totally fill the test tube prior to counting the bubbles.
- If working in small groups, each member can be responsible for counting bubble formation in the tubes (multiple conditions can occur at once).

Results

Time (minutes)	Number of Bubbles Produced			
	Glucose	Fructose	Lactose	Sucrose
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
TOTAL				

Graph

Graph the cumulative number of bubbles produced per minute for each of the four sugar types.



Discussion

1. Describe the experimental results and compare them against your predicted outcomes.

2. Propose an appropriate control group for this experiment and describe its purpose.

3. Suggest one way the methodology could have been modified to improve the accuracy.

4. Outline how oxygen levels in the tubes (or dissolved into solution) could have affected results.