

Name:

Respiration by Yeast — Student Worksheet

Goal

Investigate how yeast respiration affects the temperature of a yeast + sugar mixture in an insulated cup.



Materials

- Dry yeast ($\approx 2\text{--}5\text{ g}$)
- Granulated sugar
- Warm water (approx. $35\text{--}40^\circ\text{C}$) — enough for several 25 cm^3 samples
- Insulated cups (e.g., paper cup inside another cup, or foam cup) — at least 3
- 3 identical thermometers (or 1 thermometer used sequentially if careful)
- Measuring cylinder or syringe for 25 cm^3 volumes
- Stirring rod or spoon
- Stopwatch or timer
- Labels / masking tape and marker
- Data sheet and pen
- Safety goggles (recommended)
- Optional: ice water bath and hot water bath for preparing different starting temperatures

Procedure

1. Measure 25 cm³ of yeast suspension (mix a small measured amount of dry yeast with warm water; swirl gently). Pour into an insulated cup labeled A. Repeat for cups B and C.
2. Add 25 cm³ of the appropriate sugar solution to each cup:
 - Cup A (control): add 25 cm³ plain water (0 g sugar)
 - Cup B: add 25 cm³ of 5 g (1/2 tablespoon) sugar solution
 - Cup C: add 25 cm³ of 10 g (1 tablespoon) sugar solution
3. Immediately after adding the sugar solution, place the thermometer into the mixture. Make sure the bulb is fully submerged but not touching the cup bottom.
4. Start the timer. Record the starting temperature (t = 0).
5. Record temperature at regular intervals (suggested: every 5 minute for 15 minutes).
6. Clean equipment and dispose of mixtures.

Data Table

Record all trials in the table below.

Cup (treatment)	Temperature				
	t=0	t=5	t=10	t=15	ΔT
A: 0 g sugar					
B: 5 g sugar					
C: 10 g sugar					

Prediction

Write your hypothesis in one sentence, for example:

Prediction: "The cup with more sugar (10 g) will show a greater temperature increase than the cups with less or no sugar because more sugar supplies more substrate for yeast respiration."

Observations to Record

- Temperature readings at each time point.
- Any visible bubbling or frothing.
- Smell changes (CO₂ / fermentation odor).
- How quickly temperature rises or falls.
- Any experimental problems (thermometer touching sides, spills, inconsistent stirring).

Discussion Questions

1. Are there any bubbles? Why? Predict the compound of the bubble?
2. Which treatment showed the largest temperature increase (greatest ΔT)?
3. Does the result support your prediction? Explain why or why not.
4. Why does yeast + sugar produce heat?
5. What role did the control (0 g sugar) play in this experiment?
6. Suggest at least two sources of experimental error that could affect the temperature readings. How would you reduce them?
7. How does repeating trials help the reliability of your results?
8. If you wanted to measure the rate of respiration more directly, what could you measure besides temperature?
9. Based on your data, what is the relationship between sugar concentration and respiration (as inferred from temperature)?
10. Propose one modification to this experiment to improve accuracy.