Name _____ Teacher _____ Date _____

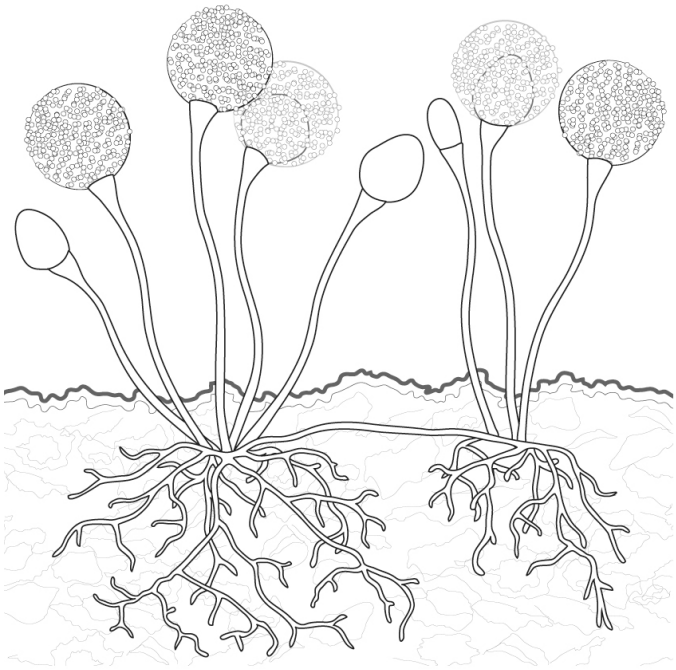
6.2: Grading Bread Mold Worksheet

*This worksheet has "grading" in the title because at this point, students can be held accountable for correct answers. Level 4 (correct) responses to the questions are in **blue bold italics** below.*

Red italics suggest ways to grade student responses by giving them points for correct or partially correct answers. There are 19 points total on this worksheet.

A. Draw and label arrows that represent the molecules that carbon atoms are in as they move into, through and out of the bread mold as it grows.

Label each arrow to show the kind of molecules that the carbon atoms are in: large organic molecules (LOM), small organic molecules (SOM), or carbon dioxide (CO_2).



Arrows should show:

- ***SOM moving from bread into hyphae***
- ***SOM moving through hyphae (and into fruiting body)***
- ***(Optional: LOM in bread and in hyphae)***
- ***CO_2 leaving hyphae***

1 point for each correct answer (3 points total)

1. What happens to the bread as the bread mold lives and grows?

Bread mold breaks down the large organic molecules of the bread into small organic molecules. [They use the starch from the bread in two ways: for biomass (for growth) and cellular respiration (for energy).]

1 point description of digestion

2. How do the bread mold's cells get oxygen from the air when they grow and function? What do they do with the oxygen?

Bread mold cells gets oxygen from the air and small organic molecules from the bread. Bread mold cells use the oxygen as one of the reactants as they perform cellular

respiration. (Some of those oxygen atoms end up in water molecules that stay in the bread mold, so a tiny percentage of oxygen atoms in the bread mold do come from air.)
1 point each for getting oxygen from air in the bread and using oxygen for cellular respiration (2 points total)

B. Investigating how bread mold grows and functions

A class is investigating the process of bread mold in decomposition. A teacher describes a scenario where there is a piece of bread with mold sitting on a paper plate. The teacher asks, "What do you think the mass of the bread with mold on the plate will be after two weeks?"

3. Three students shared their ideas about what happened. Choose whether you agree, disagree, or are not sure about each claim:

Agree	Disagree	Not sure	Margaret claims: "I think the whole system (both plate with bread with mold) will **lose mass** because the bread mold takes in molecules from the bread and converts them into CO_2 released into the air."
Agree	***Disagree***	Not sure	Abdul claims: "I think the whole system will **get heavier** because the bread mold gets bigger as it grows on the bread and nothing leaves the system."
Agree	***Disagree***	Not sure	Camila claims: "I think the whole system will have **the same mass** because the molecules in the bread will be converted into bread that stays on the plate."

1 point for correctly answering each line. (3 points total.)

4. Provide an explanation. Why did you agree or disagree with each student's claim? What are you not sure about?

Level 4 explanations will consider the two things that can happen to the bread as a food source for the bread mold (small organic molecules from digested food used either for cellular respiration and energy or biosynthesis and growth) and use this knowledge to evaluate the students' claims:

- ***Margaret's claim correctly recognizes CO_2 as a product of cellular respiration, so mass should be leaving the bread.***
- ***Abdul's claim is incorrect because it violates the principle of conservation of matter: The system cannot gain mass unless new materials enter the bread.***
- ***Camila's claim correctly recognizes that matter is conserved but does not consider the possibility that gases are leaving the system.***

1 point for providing a correct explanation for agreement or disagreement with each of the 3 claims (3 points total)

The class does an experiment. They weighed 5 pieces of bread just beginning to grow mold and set each one on a different plate. They put the plates in a warm, moist room and left them alone for two weeks. At the end of that time, they reweighed the bread with the mold. Below are their results.

Sample	Original mass of bread on plate (g)	Mass of bread on plate with mold after two weeks (g)
1	30.0	27.8
2	33.2	31
3	32.9	30.6
4	33.4	33.2

5	33.1	29.0
Average	**32.52**	**30.32**

5. What patterns do you see in the data?

Level 4 responses will focus on mass differences: On average, the bread with bread mold lost mass, so some of the matter in the bread must have gone somewhere else.

1 point for identifying that there was an overall average decrease in mass in the system

6. Which claim do you think is best supported by the data? (Circle one choice.)

Margaret's claim

Abdul's claim

Camila's claim

1 point for correct answer

7. Explain how the patterns in the data support the claim that you chose.

Level 4 responses will recognize that the data support only Margaret's claim.

1 point for choosing Margaret's claim due to mass differences.

8. What additional evidence would you collect to help show that the claim you chose is the best claim?

Responses at all levels may include generic suggestions about gathering more or more precise data: measure more bread with bread mold systems, measure the masses more accurately, measure the masses every day, etc. While these are legitimate ways of collecting additional data, they need to be accompanied by suggestions that identify specific problems with this investigation.

Level 4 responses may focus on the biggest single problem with this investigation: The failure of the procedure to account for water. What part of the "missing mass" might be water that evaporated? Other possibilities:

- ***They may also mention other variables not accounted for, such as oxygen from the atmosphere or measuring CO_2 as a product.***

1 point for identifying additional evidence that could be collected.

C. A question about how bread mold grows and functions

A loaf of bread was left alone for 2 weeks. Three different kinds of mold grew on it. Assuming the bread did not dry out, which of the following is a reasonable prediction of the mass of the bread and mold after the 2-week period?

The mass is going to:

a. *increase*, because the mold has grown.

b. *remain the same* because the mold converts bread into biomass.

c. *decrease* as the growing mold converts bread into energy.

d. ***decrease* as the mold converts bread into biomass and gases.**

1 point for correctly answering. (1 point total.)

10. Explain your reasoning. Why does the mass of the bread and mold change in the way you selected above?

Level 4 responses trace atoms/carbon from the starch into either decomposers or CO_2/a gas, or they recognize that the starch is used in cellular respiration. They also answer all of the forced-choice responses correctly.

1 point for correctly tracing the atoms from the starch in the bread.

D. Something interesting about bread mold

11. What is something interesting that you learned about bread mold from your reading and discussion?

1 point for correct fact from the reading or discussion.