Name: _____ **Date:** _____
Period: _____

Onion Chemistry: Chemical Changes Exam

Instructions: This exam consists of multiple choice, multi-select, and short CER writing questions. Be sure to read each question carefully. Be sure to support your answers.

Multiple Choice (1 point each)

Select the best answer for each question.

1. What type of change occurs when an onion is chopped, releasing a pungent odor and causing tears?
    - A. Physical change
    - B. Chemical change
    - C. State change
    - D. Phase separation
2. What enzyme is responsible for initiating the tear-inducing reaction in onions?
    - A. Catalase
    - B. Amylase
    - C. Alliinase
    - D. Lactase
3. What compound is directly responsible for making your eyes water when an onion is chopped?
    - A. Sulfur dioxide
    - B. syn-Propanethial-S-oxide
    - C. Hydrogen sulfide
    - D. Acetic acid
4. Cooking an onion causes which of the following processes?
    - A. Hydrolysis
    - B. Thermal decomposition
    - C. Neutralization
    - D. Freezing
5. Which type of evidence would best support that a chemical change occurred during cooking?
    - A. The onion became cold
    - B. The onion softened
    - C. The onion released new smells and turned brown
    - D. The onion was sliced thinly

6. What happens to the enzyme alliinase when onions are cooked at high heat?
    - A. It speeds up
    - B. It becomes stronger
    - C. It denatures and stops working
    - D. It multiplies
7. Which of the following best describes thermal decomposition?
    - A. The release of water from boiling
    - B. The rearrangement of atoms without energy change
    - C. A chemical breakdown caused by heat
    - D. A physical breakdown of shape
8. Which of these is NOT evidence of a chemical change in onions?
    - A. Production of a new odor
    - B. Browning of the onion
    - C. Tears from syn-Propanethial-S-oxide
    - D. Cutting the onion into pieces
9. What type of bond is broken during a chemical change in cooking onions?
    - A. Ionic bond
    - B. Covalent bond
    - C. Intermolecular force
    - D. Hydrogen bond
10. Which term best describes a reaction that absorbs heat from its surroundings?
    - A. Exothermic
    - B. Endothermic
    - C. Combustion
    - D. Catalytic

Multi-Select (Choose all that apply – 2 points each)

Choose ALL correct answers.

11. Which of the following observations suggest a chemical change occurred when an onion was cooked?

- ☐ Change in odor
- ☐ Texture softening
- ☐ Color change (browning)
- ☐ Formation of a gas

12. What changes are caused by the enzyme alliinase?

- ☐ Sulfur compound conversion
- ☐ Production of syn-Propanethial-S-oxide
- ☐ Formation of water vapor
- ☐ Browning of the onion

13. Which statements are true about syn-Propanethial-S-oxide?

- ☐ It is a product of a chemical reaction
- ☐ It is responsible for eye irritation
- ☐ It forms when heat is applied
- ☐ It results from an enzymatic reaction

14. What characteristics are associated with chemical changes?

- ☐ Formation of new substances
- ☐ Reversible phase changes
- ☐ Energy absorption or release
- ☐ Production of gases or precipitates

15. Why is caramelization considered a chemical change?

- ☐ New odor compounds form
- ☐ Color change due to new molecules
- ☐ It produces syn-Propanethial-S-oxide
- ☐ It results from heat-driven decomposition

CER Short Answer (5 points each)

Answer each CER question using the Claim-Evidence-Reasoning structure.

16. In a lab, a student chopped an onion and observed a strong smell and eye irritation. Later, the student cooked a separate portion of the onion and noticed a sweet, savory smell with a brownish color.

Prompt: Explain why chopping and cooking the onion each produced different results. Use scientific vocabulary to describe the types of changes that occurred.

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17. Two groups tested onions and garlic. Both observed new odors, but only the onion group reported eye irritation. Upon further investigation, it was found that garlic does not produce syn-Propanethial-S-oxide.

Prompt: Explain why onions cause eye irritation while garlic does not, even though both release sulfur compounds.

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18. During an experiment, students recorded the temperature at which onions started browning. They determined that chemical changes occurred at temperatures above 150°C due to the smell and color changes.

Prompt: Explain why the browning of onions is a chemical change and how heat contributes to this transformation.

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