

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Smash Through Phase Changes and Critical Points (8th Grade)

Develop a deep understanding of thermodynamics and molecular behavior by analyzing non-Newtonian fluids, triple points, and intermolecular forces.

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**1. At the surface of a high-altitude mountain peak, water boils at a lower temperature than it does at sea level. Which statement best analyzes the molecular reason for this phenomenon?**

- A. Lower air density increases the kinetic energy of the water molecules.
- B. Reduced atmospheric pressure allows vapor pressure to equal ambient pressure at lower thermal energy.
- C. The lack of oxygen prevents hydrogen bonds from forming effectively.
- D. Gravity is weaker at high altitudes, making it easier for molecules to escape into the air.

**2. Substances like Oobleck (cornstarch and water) exhibit properties of both solids and liquids depending on the force applied; these are scientifically classified as \_\_\_\_\_ fluids.**

- A. Supercritical
- B. Crystalline
- C. Non-Newtonian
- D. Amorphous

**3. A substance at its 'triple point' exists in a state where solid, liquid, and gas phases coexist in thermodynamic equilibrium.**

- A. True
- B. False

**4. In a closed system, an increase in temperature usually results in an increase in gas pressure. According to the Kinetic Molecular Theory, why does this happen?**

- A. The gas particles expand and take up more individual volume.
- B. The particles stick together, creating larger impact masses.
- C. Particles move faster and collide with the container walls more frequently and with more force.
- D. D

**5. When iodine crystals are heated and transform directly into a purple vapor without becoming a liquid first, the process is called \_\_\_\_\_.**

- A. Vaporization
- B. Sublimation
- C. Deposition
- D. Condensation

**6. Plasma is the most common state of matter in the visible universe, even though it is rarely found naturally on Earth's surface.**

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- A. True
- B. False

**7. Which of the following would require the GREATEST removal of energy (exothermic change) from a substance?**

- A. Condensing steam into liquid water.
- B. Freezing liquid water into ice.
- C. Lowering the temperature of ice from  $-5^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$ .
- D. Depositing water vapor directly into frost crystals.

**8. Unlike crystalline solids like salt, \_\_\_\_\_ solids like glass lack a long-range periodic internal structure and do not have a sharp melting point.**

- A. Plasma
- B. Metallic
- C. Amorphous
- D. Ionic

**9. During a phase change, such as water boiling, the temperature of the substance continues to rise as long as heat is being added.**

- A. True
- B. False

**10. Supercritical fluids, often used in industrial decaffeination, occur when a substance is held above its critical temperature and pressure. What makes this state unique?**

- A. It has the density of a gas but the flow of a solid.
- B. It has the density of a liquid but can diffuse through solids like a gas.
- C. It can only exist in a vacuum environment.
- D. It is the only state of matter where particles stop moving entirely.