Name: _____ **Date:** _____

Answer Key: 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?

Answer: B) Reduced atmospheric pressure allows vapor pressure to equal ambient pressure at lower thermal energy.

Boiling occurs when a liquid's vapor pressure equals the surrounding atmospheric pressure. At high altitudes, there is less pressure pushing down on the liquid, so molecules need less heat (kinetic energy) to transform into gas.

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.

Answer: C) Non-Newtonian

Non-Newtonian fluids do not have a constant viscosity; their flow properties change under stress or force, unlike 'Newtonian' fluids like water.

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

Answer: A) True

The triple point is a specific temperature and pressure condition where all three primary states of matter are stable and coexist.

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?

Answer: C) Particles move faster and collide with the container walls more frequently and with more force.

Temperature is a measure of average kinetic energy. Higher temperatures mean faster-moving particles, leading to more energetic and frequent collisions, which we measure as pressure.

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

Name: _____ **Date:** _____

Answer: B) Sublimation

Sublimation is the endothermic phase transition where a solid transitions directly into a gas, skipping the liquid phase entirely.

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

Answer: A) True

Since stars (including our sun) are composed of plasma, it makes up over 99% of the visible matter in the universe.

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

Answer: D) Depositing water vapor directly into frost crystals.

Deposition requires the most energy removal because the substance transitions from a high-energy state (gas) directly to a low-energy state (solid), combining the energy loss of both condensation and freezing.

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

Answer: C) Amorphous

Amorphous solids have a disordered molecular structure, which causes them to soften gradually over a range of temperatures rather than melting at one specific point.

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

Answer: B) False

During a phase change, the temperature remains constant because the added thermal energy is used to break intermolecular bonds rather than increase the speed (kinetic energy) of the particles.

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?

Answer: B) It has the density of a liquid but can diffuse through solids like a gas.

Supercritical fluids show a unique blend of properties where they can dissolve materials like a liquid but spread out and penetrate spaces as easily as a gas.

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