Name: _____ **Date:** _____

Answer Key: Solve the Mystery of Your Disappearing Molecules: A 4th Grade Phase Change Quiz

Analyze molecular behavior across diverse environments while predicting phase changes like deposition using the principles of kinetic energy and thermal transfer.

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1. A chef in a high-altitude mountain kitchen notices that water boils faster than at sea level. Which statement best explains this phenomenon from a molecular perspective?

Answer: B) Lower air pressure makes it easier for liquid molecules to escape into a gas state.

Boiling occurs when the internal pressure of the liquid equals the external air pressure; lower air pressure requires less energy for molecules to transition to gas.

2. When a gas undergoes deposition to become a solid, the molecules must gain a significant amount of thermal energy.

Answer: B) False

Deposition requires a loss of thermal energy as gas molecules slow down significantly to form a rigid solid structure.

3. Imagine you leave a block of solid 'dry ice' on a table. It seemingly vanishes without leaving a puddle. This process of a solid turning directly into a gas is called _____.

Answer: C) Sublimation

Sublimation is a phase change where a substance transitions specifically from a solid to a gas without passing through the liquid phase.

4. If you were to observe the molecules of molten volcanic lava (a liquid) and compare them to the molecules of a solidified basalt rock, what is the primary difference in their behavior?

Answer: C) The lava molecules have more kinetic energy and slide past one another.

Liquids have higher kinetic energy than solids, allowing molecules to move fluidly, whereas solid molecules are locked into a vibrating pattern.

5. A scientist is studying a substance that has no fixed shape and expands to fill the entire volume of any container it is placed in. This substance must be in the _____ state.

Answer: A) Gas

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Gases have high-energy particles that move independently, filling whatever space is available regardless of the container's size.

6. Evaporation can only occur if a liquid reaches its specific boiling point.

Answer: B) False

Evaporation is a surface phenomenon that can happen at temperatures below the boiling point as individual molecules gain enough energy to escape.

7. On a very cold morning, you see 'hoar frost' (ice crystals) appearing on a tree branch, even though it did not rain or snow. Which phase change describes the transition from water vapor in the air directly to these ice crystals?

Answer: C) Deposition

Deposition is the process where a gas (water vapor) turns directly into a solid (ice) without becoming a liquid first.

8. When you boil a pot of soup, you see a 'cloud' rising above it. This cloud is actually tiny water droplets formed when steam cools down. This specific process is known as _____.

Answer: B) Condensation

Condensation occurs when a gas loses thermal energy and its molecules slow down enough to cluster together into a liquid state.

9. A substance in its solid state has a definite volume and a definite shape because its particles are arranged in a rigid, fixed pattern.

Answer: A) True

The strong attractive forces between particles in a solid keep them in a fixed position, maintaining both shape and volume.

10. Which of these scenarios would lead to the GREATEST increase in the kinetic energy of a substance's molecules?

Answer: C) Heating a beaker of liquid water until it turns into steam.

Adding heat increases the kinetic energy (speed) of molecules. Transitioning from liquid to gas requires a massive energy input compared to the other options.