Name: _____ **Date:** _____

Answer Key: Molecular Motion: Marshmallow Matter Models for 6th Grade

Analyze kinetic energy and phase changes across 10 rigorous questions featuring industrial and culinary chemical applications.

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1. A chef is using liquid nitrogen at -196°C to flash-freeze physical property samples. Why does the nitrogen gas take up significantly more space than the liquid nitrogen?

Answer: B) The intermolecular distance between particles increases as kinetic energy rises.

In the gaseous state, particles have high kinetic energy, allowing them to overcome attractive forces and spread out to fill the entire volume of a container.

2. On a very cold winter morning, your car's windshield is covered in a thin layer of ice crystals, even though it did not rain or snow. This process of a gas turning directly into a solid is called _____.

Answer: C) Deposition

Deposition is the phase change where a gas bypasses the liquid state to become a solid, such as water vapor turning into frost.

3. True or False: In a crystalline solid like Gallium metal held in a warm hand, the atoms remain in a fixed position even after the substance begins to transition into a liquid.

Answer: B) False

Once a solid reaches its melting point, the particles gain enough energy to slide past one another, losing their fixed crystalline structure.

4. Molten lava flowing down a volcano behaves differently than the solid rock it becomes. Which statement best describes the particles in the flowing lava?

Answer: B) They have enough energy to slide past each other while maintaining a fixed volume.

Liquids like lava have particles that are close together but are not locked in place, allowing the substance to flow and take the shape of its container.

5. When a scuba diver releases air bubbles underwater, the bubbles expand as they rise toward the surface. This happens because gas has _____.

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Answer: C) No definite volume or shape

Gases lack a fixed volume; they expand or compress based on the pressure and volume of their environment.

6. True or False: Adding thermal energy to a beaker of boiling water will cause the temperature of the water to rise above 100°C while it is still in the liquid phase at standard pressure.

Answer: B) False

During a phase change, the temperature remains constant because the added energy is used to break intermolecular bonds rather than increase particle speed.

7. Consider a block of dry ice (solid carbon dioxide) sitting on a table. You notice it getting smaller, but there is no puddle of liquid. This is an example of:

Answer: B) Sublimation

Sublimation occurs when a solid gains enough energy to transition directly into a gas, skipping the liquid phase entirely.

8. The property of a liquid that describes its resistance to flowing, such as comparing the flow of maple syrup to water, is known as _____.

Answer: B) Viscosity

Viscosity is a physical property of liquids determined by particle friction and attraction; higher viscosity means the liquid flows more slowly.

9. True or False: When water vapor touches a cold soda can and forms droplets, the water molecules are losing kinetic energy.

Answer: A) True

Condensation is an exothermic process where gas molecules slow down (lose kinetic energy) and come together to form a liquid.

10. Why can a gas be easily compressed into a small cylinder (like a propane tank), but a solid iron bolt cannot?

Answer: C) There is a vast amount of empty space between gas particles.

Compression requires space between particles. Gas particles are far apart, while solid particles are tightly packed with almost no space between them.

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