Name: _____ **Date:** _____

Answer Key: Molecular Chaos vs. Lattice Order: 11th Grade Chemistry Challenge

Students analyze intermolecular force competition and phase boundary behavior during this rigorous summative assessment for advanced chemistry learners.

---

1. Supercritical fluids, such as carbon dioxide handled at 31.1°C and 72.9 atm, exhibit a unique physical state. Which statement best evaluates their molecular behavior?

Answer: A) They possess the density of a liquid but the diffusivity of a gas.

Beyond the critical point, the distinction between liquid and gas disappears; the resulting fluid expands to fill containers like a gas but retains high density and solvent properties like a liquid.

2. True or False: In a closed system at the triple point of water, the rate of sublimation is exactly equal to the rate of deposition.

Answer: A) True

At the triple point, all three phases exist in dynamic equilibrium, meaning every phase transition occurs at the same rate as its inverse process.

3. The phase diagram of ___ is anomalous because the solid-liquid boundary curve has a negative slope, meaning the melting point decreases as pressure increases.

Answer: B) Water

Due to the open hexagonal lattice structure of ice caused by hydrogen bonding, solid water is less dense than liquid water, causing the melting point to drop under pressure.

4. Considering the Clausius-Clapeyron relation, how does an increase in the molar enthalpy of vaporization change the slope of the vapor pressure curve?

Answer: C) It creates a steeper increase in vapor pressure for a given temperature rise.

A higher enthalpy of vaporization implies stronger intermolecular forces; thus, the vapor pressure is more sensitive to temperature changes, resulting in a steeper curve on a P-T graph.

5. A substance that lacks a long-range periodic crystalline structure but possesses the mechanical rigidity of a solid is classified as a/an ___ solid.

Name: _____ **Date:** _____

Answer: B) Amorphous

Amorphous solids, like glass or certain plastics, do NOT have the ordered geometric repetition of crystals and often soften over a range of temperatures rather than having a sharp melting point.

6. True or False: According to Kinetic Molecular Theory, the average kinetic energy of gas particles is inversely proportional to the Kelvin temperature.

Answer: B) False

Average kinetic energy is directly proportional to temperature in Kelvin (KE = 3/2 kT); as temperature increases, particle velocity increases.

7. In the context of the Van der Waals equation, what does the 'a' constant correct for regarding the behavior of non-ideal gases?

Answer: C) The attractive intermolecular forces between the gas molecules.

The 'a' term accounts for the IMF (intermolecular forces) that reduce the pressure exerted by a real gas compared to an ideal gas.

8. In a heating curve for a pure substance, the plateau during the transition from liquid to gas represents the ____, where added energy breaks intermolecular bonds rather than increasing temperature.

Answer: C) Enthalpy of Vaporization

The Enthalpy (or Latent Heat) of Vaporization is the energy required to change a substance from liquid to gas at constant temperature by overcoming attractive forces.

9. True or False: Surface tension in a liquid decreases as temperature increases because kinetic energy better opposes the inward intermolecular cohesive forces.

Answer: A) True

As temperature rises, molecules move more vigorously, weakening the net effect of the cohesive forces that create surface tension.

10. Which of the following conditions would most likely cause a real gas to deviate significantly from the Ideal Gas Law (PV=nRT)?

Answer: C) Low temperature and high pressure.

Name: _____ **Date:** _____

At low temperatures, kinetic energy is low enough for IMFs to matter; at high pressure, the volume of the particles themselves becomes a significant fraction of the total volume.