Name: _____ **Date:** _____

Answer Key: Under Pressure: Can You Predict the Phase Change for 12th Grade AP Chemistry?

Quantify intermolecular forces through vapor pressure calculations and phase diagram analysis to determine how volatile chemicals behave in extreme environments.

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1. Which set of conditions is required for a substance to undergo deposition in a system currently at its triple point?

Answer: B) Decreasing the temperature while maintaining constant pressure.

Deposition is the phase transition from gas directly to solid. At the triple point, all three phases coexist; decreasing the temperature at constant pressure moves the substance into the solid region of the phase diagram.

2. The resistance of a liquid to flow, which typically decreases as kinetic energy increases, is known as _____.

Answer: C) Viscosity

Viscosity measures a fluid's internal friction. As temperature increases, the increase in kinetic energy overcomes intermolecular forces, allowing the molecules to slide past each other more easily.

3. Amorphous solids, such as glass, possess a distinct and sharp melting point due to their long-range repeating geometric patterns.

Answer: B) False

Amorphous solids lack long-range metabolic order; they soften over a range of temperatures rather than having a fixed melting point like crystalline solids.

4. According to the Clausius-Clapeyron equation, if a liquid has strong intermolecular forces, what can be inferred about its vapor pressure?

Answer: C) It will have a low equilibrium vapor pressure at room temperature.

Strong intermolecular forces (IMFs) hold molecules together in the liquid phase more tightly, meaning fewer molecules have enough energy to escape into the gas phase, resulting in a lower vapor pressure.

5. Sulfur hexafluoride (SF6) behaves as a _____ when it is heated and pressurized beyond its specific critical point, where the distinction between liquid and gas vanishes.

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Answer: B) Supercritical fluid

Above the critical temperature and pressure, a substance becomes a supercritical fluid, possessing the density of a liquid but the expansion properties of a gas.

6. The molar heat of fusion is generally smaller than the molar heat of vaporization for a given substance.

Answer: A) True

Vaporization requires completely overcoming intermolecular forces to move particles far apart, while fusion only requires partially disrupting the forces to allow particles to move past each other.

7. Why does water exhibit a negative slope for the solid-liquid boundary line on its phase diagram?

Answer: B) The liquid phase is more dense than the solid phase due to hydrogen bonding.

Unlike most substances, high pressure favors the more dense liquid phase of water over the less dense solid (ice), causing the melting point to decrease as pressure increases.

8. While heating a substance, the temperature remains constant during a phase change because the added energy is used to increase _____ energy rather than kinetic energy.

Answer: A) Potential

During a phase change, energy added is used to break or weaken intermolecular bonds (increasing potential energy) rather than increasing the speed of the particles (kinetic energy).

9. Liquid Nitrogen (bp -196°C) is stored in a Dewar flask. If the flask is sealed and the temperature rises to 25°C, what serves as the primary danger regarding states of matter?

Answer: B) Rapid expansion from liquid to gas state creates immense pressure.

Gases occupy much larger volumes than their liquid counterparts. In a sealed container, the transition from liquid to gas as temperature rises generates dangerous levels of pressure.

10. In a vacuum where the external pressure is effectively zero, a liquid will boil regardless of the temperature provided it stays above its freezing point.

Answer: A) True

Boiling occurs when vapor pressure equals external pressure. If external pressure is zero, any non-zero vapor pressure (which all liquids possess above freezing) will facilitate boiling.

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