Name _____

AP Chemistry: Liquids & Solids
Multiple Choice

27. The critical temperature of a substance is the…

(A) temperature at which the vapor pressure of the liquid is equal to the external pressure.

(B) temperature at which the vapor pressure of the liquid is equal to 760 mm Hg.

(C) temperature at which the solid, liquid, and vapor phases are all in equilibrium.

(D) Temperature at which liquid and vapor phases are in equilibrium at I atmosphere.

(E) lowest temperature above which a substance cannot be liquefied at any applied pressure.

54. Which of the following statements is always true about the phase diagram of any one-component system?

(A) The slope of the curve representing equilibrium between the vapor and liquid phases is positive.

(B) The slope of the curve representing equilibrium between the liquid and solid phases is negative.

(C) The slope of the curve representing equilibrium between the liquid and solid phases is positive.

(D) The temperature at the triple point is greater than the normal freezing point.

(E) The pressure at the triple point is greater than 1 atmosphere.

21. Which of the following is true at the triple point of a pure substance?

(A) The vapor pressure of the solid phase always equals the vapor pressure of the liquid phase.

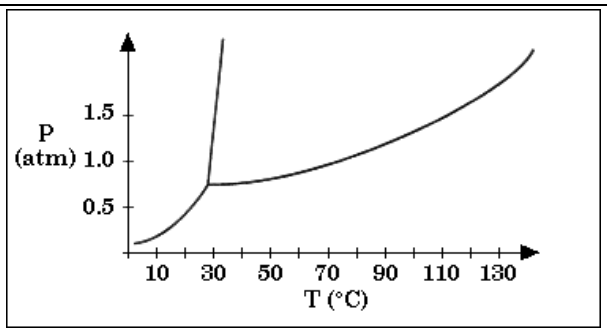
(B) The temperature is always 0.01 K lower that the normal melting point.

(C) The liquid and gas phases of the substance always have the same density and are therefore indistinguishable.

(D) The solid phase always melts if the pressure increases at constant temperature.

(E) The liquid phase always vaporizes if the pressure increases at constant temperature.

5. Questions 5-7 refer to the phase diagram on the right of a pure substance.



(A) Sublimation

(B) Condensation

(C) Solvation

(D) Fusion

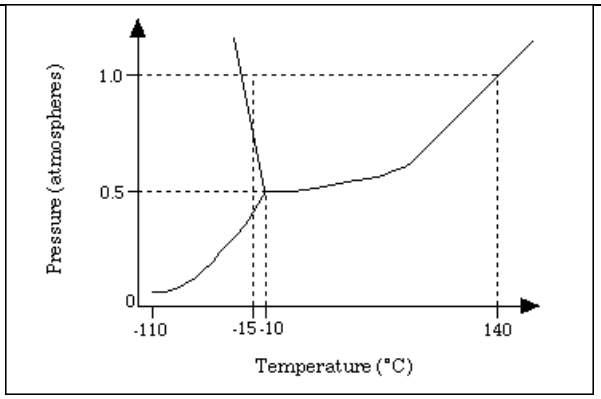
(E) Freezing

5. If the temperature increases from 10° C to 60° C at a constant pressure of 0.4 atmospheres, which of the processes occurs?

6. If the temperature decreases from 110° C to 40° C at a constant pressure of 1.1 atmospheres, which of the processes occurs?

7. If the pressure increases from 0.5 to 1.5 atmospheres at a constant temperature of 50° C, which of the processes occurs?

49. Use the following diagram for 49-51.



49. The normal boiling point of the substance represented by the phase diagram shown is…

(A) −15 °C (B) −10 °C (C) 140 °C

(D) greater than 140 °C

(E) not determinable from the diagram

50. The phase diagram above provides sufficient information for determining the…

(A) entropy change on vaporization. (B) conditions necessary for sublimation.

(C) deviations from ideal gas behavior of the gas phase. (D) latent heat of vaporization.

(E) latent heat of fusion.

51. For the substance represented in the diagram, which of the phases is most dense and which is least dense at − 15 °C?

	Most Dense	**Least Dense**
(A)	Solid	Gas
(B)	Solid	Liquid
(C)	Liquid	Solid
(D)	Liquid	Gas
(E)	The diagram gives no information about densities.	

26. Which of the following actions would be likely to change the boiling point of a sample of a pure liquid in an open container?

I. Placing it in a smaller container

II. Increasing the number of moles of the liquid in the container

III. Moving the container and liquid to a higher altitude

(A) I only (B) II only (C) III only (D) II and III only (E) I, II, and III

13. Questions 13-16 refer to the following descriptions of bonding in different types of solids.

(A) Lattice of positive and negative ions held together by electrostatic forces

(B) Closely packed lattice with delocalized electrons throughout

(C) Strong single covalent bonds with weak intermolecular forces

(D) Strong multiple covalent bonds (including bonds.) with weak intermolecular forces

(E) Macromolecules held together with strong polar bonds

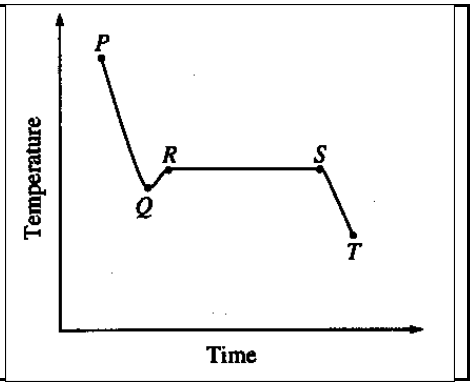
13. Cesium chloride, $CsCl_{(s)}$

14. Gold, $Au_{(s)}$

15. Carbon dioxide, $CO_{2(s)}$

16. Methane, $CH_{4(s)}$

25. The cooling curve for a pure substance as it changes from a liquid to a solid is shown right. The solid and the liquid coexist at…



(A) point Q only

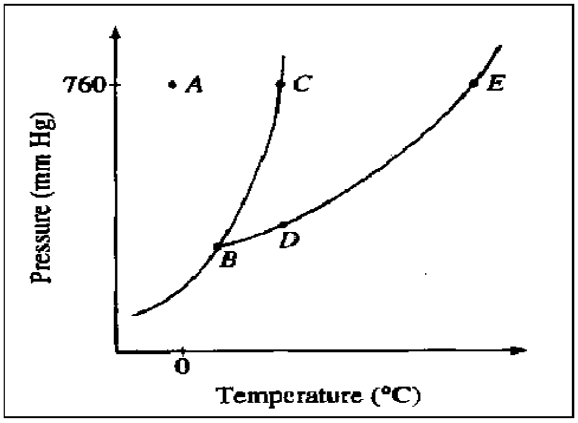
(B) point R only

(C) all points on the curve between Q and S

(D) all points on the curve between R and T

(E) no point on the curve

39. The phase diagram for a pure substance is shown at the right. Which point on the diagram corresponds to the equilibrium between the solid and liquid phases at the normal melting point?



(A) A

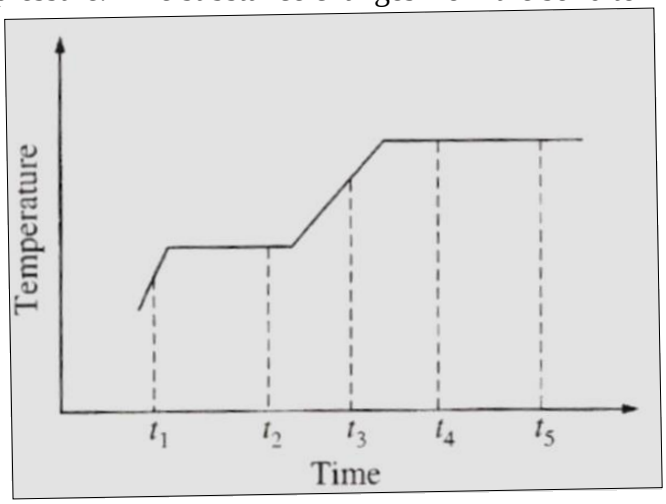
(B) B

(C) C

(D) D

(E) E

Questions 15-16 relate to the graph shown on the right. The graph shows the temperature of a pure substance as it is heated at a constant rate in an open vessel at 1.0 atm pressure. The substance changes from the solid to the liquid to the gas phase.



15. The substance is at its normal freezing point at time…
(A) t_1 (B) t_2 (C) t_3 (D) t_4 (E) t_5

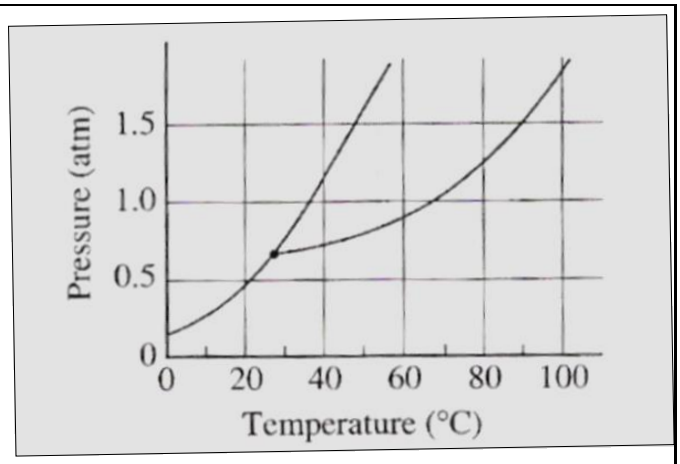
16. Which of the following best describes what happens to the substance between t_4 and t_5?

(A) The molecules are leaving the liquid phase.
(B) The solid and liquid phases coexist in the equilibrium.
(C) The vapor pressure of the substance is decreasing.
(D) The average intermolecular distance is decreasing.
(E) The temperature of the substance is increasing.

29. The best explanation for the fact that diamond is extremely hard is that diamond crystals…

(A) are made up of atoms that are intrinsically hard because of their electronic structures
(B) consist of positive and negative ions that are strongly attracted to each other
(C) are giant molecules in which each atom forms strong covalent bonds with all of its neighboring atoms
(D) are formed under extreme conditions of temperature and pressure
(E) contain orbitals or bands of delocalized electrons that belong not to single atoms but to each crystal as a whole

18. The phase diagram for the pure substance X is shown on the right. The temperature of a sample of pure solid X is slowly raised from 10°C to 100°C at a constant pressure of 0.5 atm. What is the expected behavior of the substance?



(A) It first melts to a liquid and then boils at about 70°C.
(B) It first melts to a liquid and then boils at about 30°C.
(C) It melts to a liquid at a temperature of about 20°C and remains a liquid until the temperature is greater than 100°C.
(D) It sublimes to a vapor at an equilibrium temperature of about 20°C.
(E) It remains a solid until the temperature is greater than 100°C.

32. Which of the following oxides is a gas at 25°C and 1 atm?

(A) Rb_2O (B) N_2O (C) Na_2O_2 (D) SiO_2 (E) La_2O_3

48. Sodium chloride is LEAST soluble in which of the following liquids?

(A) H_2O (B) CCl_4 (C) HF (D) CH_3OH (E) CH_3COOH

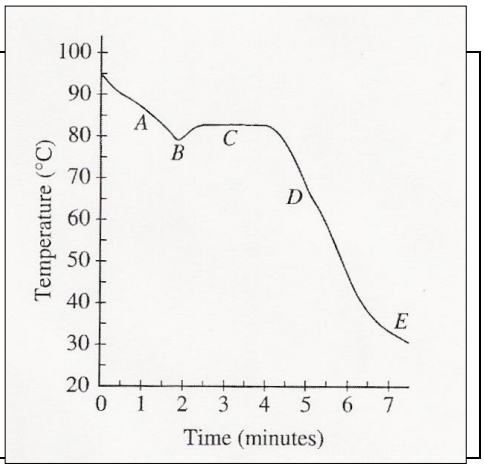
67. Which of the following describes the changes in forces of attraction that occur as H_2O changes phase from a liquid to a vapor?

(A) H-O bonds break as H-H and O-O bonds form.
(B) Hydrogen bonds between H_2O molecules are broken.
(C) Covalent bonds between H_2O molecules are broken.
(D) Ionic bonds between H^+ ions and OH^- ions are broken.
(E) Covalent bonds between H^+ ions and H_2O molecules become more effective.

70. Of the following pure substances, which has the highest melting point?

(A) S_8 (B) I_2 (C) SiO_2 (D) SO_2 (E) C_6H_6

68. Liquid naphthalene at 95 °C was cooled to 30 °C, as represented in the cooling curve shown. From which section of the curve can the melting point of naphthalene be determined?



(A) A (B) B (C) C (D) D (E) E