

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) A sample of a gas (5.0 mol) at 1.0 atm is expanded at constant temperature from 10 L to 15 L. The final pressure is \_\_\_\_\_ atm. 1) \_\_\_\_\_  
A) 7.5 B) 15 C) 3.3 D) 0.67 E) 1.5
- 2) A gas in a 325 mL container has a pressure of 695 torr at 19°C. There are \_\_\_\_\_ mol of gas in the flask. 2) \_\_\_\_\_  
A) 9.42  
B)  $1.24 \times 10^{-2}$   
C) 80.6  
D)  $1.48 \times 10^{-2}$   
E) 12.4
- 3) The molecular weight of a gas that has a density of 6.70 g/L at STP is \_\_\_\_\_ g/mol. 3) \_\_\_\_\_  
A) 3.35  
B)  $4.96 \times 10^2$   
C)  $2.98 \times 10^{-1}$   
D)  $1.50 \times 10^2$   
E)  $7.30 \times 10^1$
- 4) Which of the following statements about gases is false? 4) \_\_\_\_\_  
A) Gases expand spontaneously to fill the container they are placed in.  
B) Distances between molecules of gas are very large compared to bond distances within molecules.  
C) All gases are colorless and odorless at room temperature.  
D) Gases are highly compressible.  
E) Non-reacting gas mixtures are homogeneous.
- 5) The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because \_\_\_\_\_. 5) \_\_\_\_\_  
A) the gas molecules collide less frequently with the wall  
B) the gas molecules collide more frequently with the wall  
C) the average kinetic energy of the gas molecules decreases  
D) the gas molecules collide more energetically with the wall  
E) both the gas molecules collide more frequently with the wall and the gas molecules collide more energetically with the wall

6) Based on molecular mass and dipole moment of the five compounds in the table below, which should have the highest boiling point?

6) \_\_\_\_\_

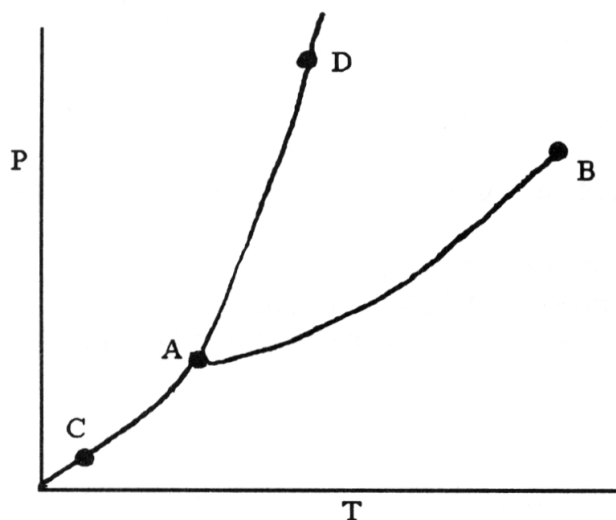
Substance	Molecular Mass (amu)	Dipole Moment (D)
Propane, $\text{CH}_3\text{CH}_2\text{CH}_3$	44	0.1
Dimethylether, $\text{CH}_3\text{OCH}_3$	46	1.3
Methylchloride, $\text{CH}_3\text{Cl}$	50	1.9
Acetaldehyde, $\text{CH}_3\text{CHO}$	44	2.7
Acetonitrile, $\text{CH}_3\text{CN}$	41	3.9

- A)  $\text{CH}_3\text{OCH}_3$
- B)  $\text{CH}_3\text{CHO}$
- C)  $\text{CH}_3\text{CN}$
- D)  $\text{CH}_3\text{CH}_2\text{CH}_3$
- E)  $\text{CH}_3\text{Cl}$

7) Which one of the following should have the lowest boiling point?

7) \_\_\_\_\_

- A)  $\text{PH}_3$
- B)  $\text{H}_2\text{S}$
- C)  $\text{SiH}_4$
- D)  $\text{H}_2\text{O}$
- E)  $\text{HCl}$



8) On the phase diagram shown above, segment \_\_\_\_\_ corresponds to the conditions of temperature and pressure under which the solid and the gas of the substance are in equilibrium.

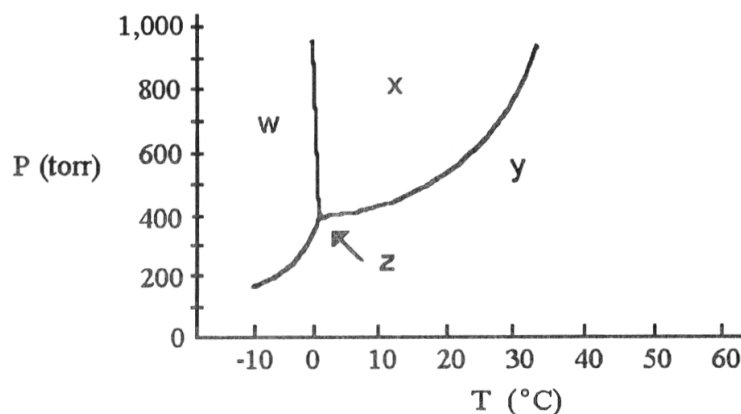
8) \_\_\_\_\_

- A) AD
- B) BC
- C) AC
- D) CD
- E) AB

9) On the phase diagram shown above, the coordinates of point \_\_\_\_\_ correspond to the critical temperature and pressure.

9) \_\_\_\_\_

- A) A
- B) B
- C) C
- D) D
- E) E



- 10) The phase diagram of a substance is shown above. The area labeled \_\_\_\_\_ indicates the gas phase for the substance. 10) \_\_\_\_\_  
 A) w B) x C) y D) z E) y and z
- 11) According to the phase diagram shown above, the normal boiling point of this substance is \_\_\_\_\_ °C. 11) \_\_\_\_\_  
 A) 10 B) -3 C) 29 D) 38 E) 0
- 12) As a solid element melts, the atoms become \_\_\_\_\_ and they have \_\_\_\_\_ attraction for one another. 12) \_\_\_\_\_  
 A) more separated, less  
 B) more separated, more  
 C) larger, greater  
 D) closer together, less  
 E) closer together, more

- 13) Based on the following information, which compound has the strongest intermolecular forces? 13) \_\_\_\_\_

Substance	$\Delta H_{\text{vap}}$ (kJ/mol)
Argon (Ar)	6.3
Benzene (C <sub>6</sub> H <sub>6</sub> )	31.0
Ethanol (C <sub>2</sub> H <sub>5</sub> OH)	39.3
Water (H <sub>2</sub> O)	40.8
Methane (CH <sub>4</sub> )	9.2

- A) Argon B) Ethanol C) Benzene D) Methane E) Water
- 14) A volatile liquid is one that \_\_\_\_\_. 14) \_\_\_\_\_  
 A) is highly flammable  
 B) is highly cohesive  
 C) is highly viscous  
 D) readily evaporates  
 E) is highly hydrogen-bonded

- 15) In general, the vapor pressure of a substance increases as \_\_\_\_\_ increases. 15) \_\_\_\_\_  
A) hydrogen bonding  
B) viscosity  
C) temperature  
D) surface tension  
E) molecular weight
- 16) The process of solute particles being surrounded by solvent particles is known as \_\_\_\_\_. 16) \_\_\_\_\_  
A) dehydration  
B) salutation  
C) solvation  
D) agglutination  
E) agglomeration
- 17) The concentration of nitrate ion in a solution that contains 0.900 M aluminum nitrate is \_\_\_\_\_ 17) \_\_\_\_\_  
M.  
A) 0.450                      B) 0.900                      C) 0.300                      D) 2.70                      E) 1.80
- 18) The concentration of KBr in a solution prepared by dissolving 2.21 g of KBr in 897 g of water is \_\_\_\_\_ 18) \_\_\_\_\_  
\_\_\_\_\_ molal.  
A) 0.0186  
B) 0.0167  
C) 0.0207  
D)  $2.07 \times 10^{-5}$   
E) 2.46
- 19) Which one of the following substances is more likely to dissolve in  $\text{CCl}_4$ ? 19) \_\_\_\_\_  
A) NaCl  
B)  $\text{CBr}_4$   
C)  $\text{CH}_3\text{CH}_2\text{OH}$   
D) HCl  
E) HBr
- 20) Which one of the following is most soluble in water? 20) \_\_\_\_\_  
A)  $\text{CH}_3\text{CH}_2\text{OH}$   
B)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$   
C)  $\text{CH}_3\text{OH}$   
D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$   
E)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- 21) Molality is defined as the \_\_\_\_\_. 21) \_\_\_\_\_  
A) moles solute/kg solvent  
B) moles solute/moles solvent  
C) moles solute/Liters solution  
D) moles solute/kg solution  
E) none (dimensionless)

- 22) A balloon originally had a volume of 4.39 L at 44 °C and a pressure of 729 torr. The balloon must be cooled to \_\_\_\_\_ °C to reduce its volume to 3.78 L (at constant pressure). 22) \_\_\_\_\_  
A) 38                      B) 546                      C) 273                      D) 0                      E) 72.9
- 23) If 3.21 mol of a gas occupies 56.2 L at 44°C and 793 torr, 5.29 mol of this gas occupies \_\_\_\_\_ L under these conditions. 23) \_\_\_\_\_  
A) 478                      B) 61.7                      C) 92.6                      D) 14.7                      E) 30.9
- 24) A gas originally at 27°C and 1.00 atm pressure in a 3.9 L flask is cooled at constant pressure until the temperature is 11°C. The new volume of the gas is \_\_\_\_\_ L. 24) \_\_\_\_\_  
A) 4.1                      B) 0.27                      C) 0.24                      D) 3.7                      E) 3.9