CHEM-1211
Fall 2013
Third Examination
Form A

Multiple Choice - Choose the BEST Answer

1. How much faster does $CH_4(g)$ effuse through a porous plug than $O_2(g)$ under the same conditions of pressure and temperature?

    A) 0.997 times faster
    B) 0.708 times faster
    C) 1.41 times faster
    D) They travel at the same speed.
    E) Not enough information given.

2. The *nb* term in the van der Waals equation accounts for the _____.

    A) volume of the container
    B) Joule-Thomson effect
    C) decrease in volume as temperature decreases
    D) attractive force between molecules
    E) finite volume occupied by the gas molecules

3. Consider the following drawing represents the same gas at two different temperatures. Which of the following statements is true?
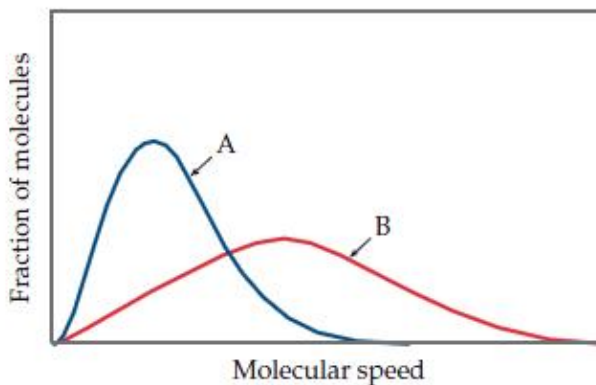
    A) The gas is at a higher temperature for curve A than for curve B.
    B) The gas is at a lower temperature for curve A than for curve B.
    C) The fraction of molecules with higher speeds increases when the sample is cooled.
    D) The two curves are not of the same gas; they have different distributions therefore they are different gases.
    E) Both A and C are correct.

Multiple Choice - Choose the BEST Answer

4. Dipole–induced-dipole interaction results from:

    A) strong attractive forces in ionic compounds.
    B) the interaction between dipoles of polar molecule.
    C) the interaction between an instantaneous dipole on a nonpolar molecule and nonpolar molecules.
    D) the interaction between an ion and a polar molecule.
    E) the interaction between a polar molecule and nonpolar molecules.

5. Choose the pair of substances that are most likely to form homogeneous solutions over a wide range of compositions at STP.

    A) KI and Hg
    B) C_3H_8 and C_2H_5OH
    C) $(CH_3)_2CO$ and H_2O
    D) C_6H_6 and HCOOH
    E) LiCl and Ar

6. Which of the following molecules would you expect to have the **lowest** boiling point?

    A) CH_3OCH_3
    B) CH_3CH_2OH
    C) $CH_3CH_2OCH_3$
    D) $CH_3CH_2CH_2OH$
    E) NaCl

7. Molecules that are _____ are particularly polarizable.

    A) small and nonpolar
    B) large and nonpolar
    C) small and polar
    D) large and polar
    E) B and D

8. The strength of intermolecular forces play the largest role in the physical properties of which type of solid?
    A) metallic
    B) ionic
    C) network
    D) molecular
    E) intermolecular forces play an equal role in all types of solids

Multiple Choice - Choose the BEST Answer

9. Out of the following, which determine the extent of solubility a solute has in a solvent?

    A) solute-solvent interactions
    B) pressure
    C) temperature
    D) solvent-solvent interactions
    E) all of the above

10.   The vapor pressure of pure water at 40°C is 55.30 torr. Calculate the mass in grams of propylene glycol ($C_3H_8O_2$) a non volatile solute that must be added to 0.340 kg of water to reduce the vapor pressure by 2.88 torr at 40°C.

    A) 78.9 g
    B) 94.7 g
    C) 18.9 g
    D) 106 g
    E) 139 g

11. Below is a molecular image of a meniscus of water in a glass tube.
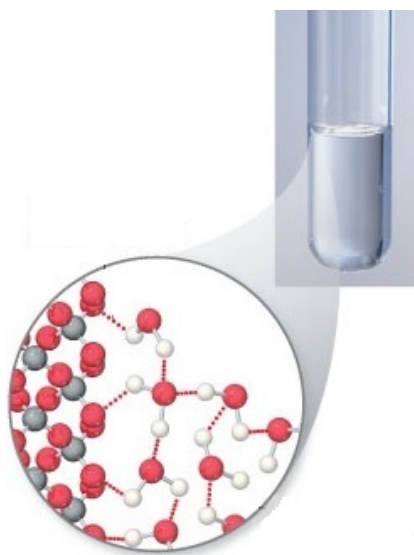


If the inside surface of the tube was coated with wax, would the general shape of the water meniscus change?

    A) Yes, because then the adhesive forces would then be greater than the cohesive forces.
    B) Yes, because then the adhesive forces would then be less than the cohesive forces.
    C) No, because then the adhesive forces would then be greater than the cohesive forces.
    D) No, because then the adhesive forces would then be less than the cohesive forces.
    E) The meniscus for water is always concave.

Multiple Choice - Choose the BEST Answer

12. The graph below shows the boiling points of the Group 4A and 6A compounds with hydrogen. Which of the following reasons best explains why Group 6A has higher boiling points than Group 4A in general?
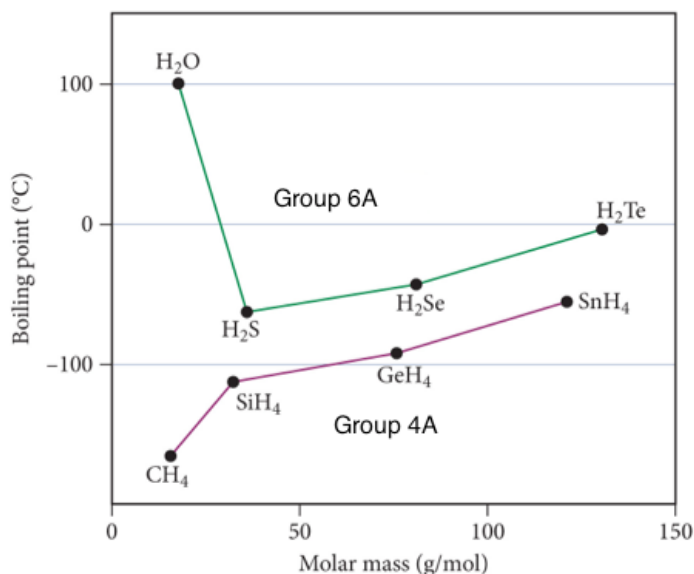

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   A) Group 4A is more polarizable than Group 6A
   B) Group 4A has hydrogen bonding present when the molecules are in the liquid phase and Group 6A does not
   C) Group 4A has stronger dipole-dipole interactions present than Group 6A molecules because of the number of electrons present
   D) Group 4A has London dispersion interactions where Group 6A does not.
   E) None of the above

13. Nickel has density of 8.908 g/cm³ and crystallizes with the face-centered cubic unit cell. What is the radius of a nickel atom in pm?

   A) 154.7 pm
   B) 121.1 pm
   C) 152.6 pm
   D) 124.6 pm
   E) 186.2 pm

Multiple Choice - Choose the BEST Answer

14. The DNA double helix at the atomic level looks like a twisted ladder, where the "rungs" of the ladder consist of molecules that are attracted to each other. Sugar and phosphate groups make up the sides of the ladder. Shown are the structures of the adenine-thymine (AT) "base pair" and the guanine-cytosine (GC) "base pair."
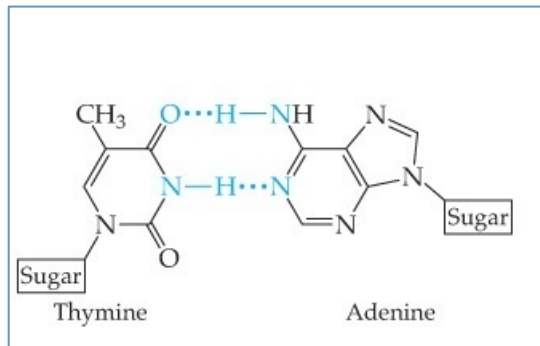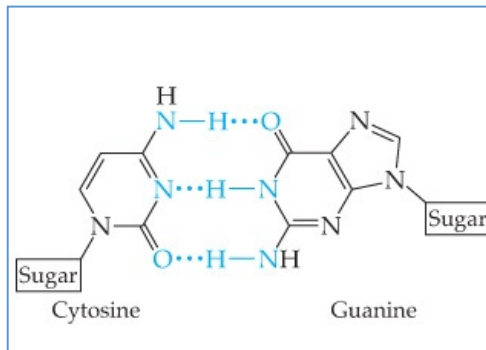
AT base pair   **GC base pair**

Which base pair is more stable to heating?
    A) AT base pair
    B) GC base pair
    C) Both base pairs are equivalent when it comes to heating
    D) Heating will not affect the base pairs
    E) Not enough information.

15. A 100.0 mL aqueous sodium chloride solution is 13.5% NaCl by mass and has a density of 1.12 g/mL. Would you add solute or solvent and at what mass to make the boiling point of the solution 104.4°C? The K_b for water is 0.51°C/m. Use the ideal value for the van't Hoff factor.

    A) 13.5 g solvent
    B) 172 g solvent
    C) 24.4 g solute
    D) 9.30 g solute
    E) The solution is already at 104.4 °C. Neither the solute nor solvent needs to be added to the solution.

Multiple Choice - Choose the BEST Answer

16. Use the phase diagram of CO_2 given below to answer the following question.   Which letter on the diagram correctly labels the place on the phase diagram where two phases: liquid and gas can be found at equilibrium?

Phase Diagram of CO_2
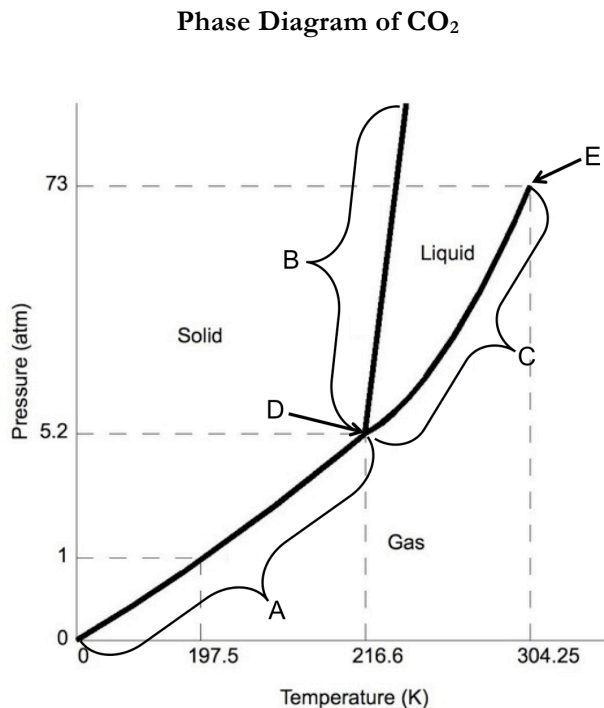
A) A
B) B
C) C
D) D
E) E

17. Substances A and B, initially at different temperatures, come in contact with each other in a closed system and a heat transfer takes place. The mass of substance A is twice the mass of substance B. The specific heat capacity of substance B is twice the specific heat capacity of substance A. Which statement is true about the final temperature of the two substances after the heat transfer?

    A) The final temperature will be higher than the initial temperatures of substances A and B.
    B) The final temperature will be exactly midway between the initial temperatures of substances A and B.
    C) The final temperature will be closer to the initial temperature of substance B than substance A.
    D) The final temperature will be closer to the initial temperature of substance A than substance B.
    E) The final temperature will be less than the initial temperatures of substances A and B.

Multiple Choice - Choose the BEST Answer

18. The value of ΔU = **-25.0** J; which of the following statements are true?

    A) The internal energy increased by 25.0 J
    B) The system lost energy
    C) The internal energy decreased by 25.0 J
    D) Both A and B
    E) Both B and C

19. Which statement(s) about heat and temperature is(are) true?

    A) Heat is the energy used to cause a temperature of an object to increase.
    B) Heat is a type of thermal kinetic energy.
    C) Heat is measured in units of energy while temperature is the measure of hotness or coldness of an object.
    D) Temperature does not have the capacity to transfer energy.
    E) All are true.

20. 25.4 g of H_2O is initially at room temperature (22.5 °C). A chilled gold rod at 2.0 °C is placed in the water. The final temperature of the system is 21.8 °C. Assuming that the calorimeter did not absorb or release heat, what is the mass of the piece of gold? $C_{s\ H2O}$ = 4.184 J/g°C; $\qquad$ $C_{s\ Au}$ = 0.129 J/g°C

    A) 29.2 g
    B) 5.62 g
    C) 74.4 g
    D) 15.5 g
    E) 22.2 g