Name:_____ Class: _____ Date: _____

CHAPTER 10 REVIEW

States of Matter

SECTION 1

SHORT ANSWER Answer the following questions in the space provided.

1. Identify whether the descriptions below describe an ideal gas or a real gas.

_____ a. The gas will not condense because the molecules do not attract each other.

_____ b. Collisions between molecules are perfectly elastic.

_____ c. Gas particles passing close to one another exert an attraction on each other.

2. The formula for kinetic energy is $KE = \frac{1}{2}mv^2$.

a. As long as temperature is constant, what happens to the kinetic energy of the colliding particles during an elastic collision?

_____

b. If two gases have the same temperature and share the same energy but have different molecular masses, which molecules will have the greater speed?

_____

3. Use the kinetic-molecular theory to explain each of the following phenomena:

a. A strong-smelling gas released from a container in the middle of a room is soon detected in all areas of that room.

_____

b. As a gas is heated, its rate of effusion through a small hole increases if all other factors remain constant.

_____

_____

4. a. _____ List the following gases in order of rate of effusion, from lowest to highest. (Assume all gases are at the same temperature and pressure.)
(a) He (b) Xe (c) HCl (d) Cl_2

SECTION 1 *continued*

b. Explain why you put the gases in the order above. Refer to the kinetic-molecular theory to support your explanation.

_____

_____

_____

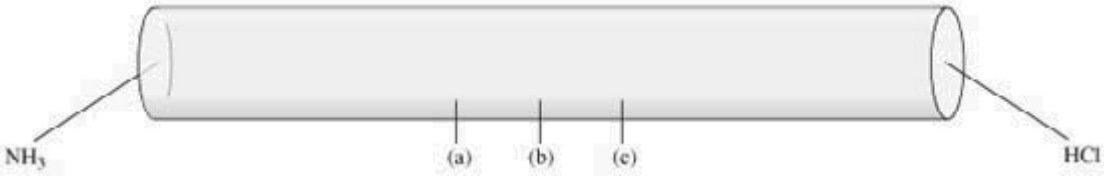
5. Explain why polar gas molecules experience larger deviations from ideal behavior than nonpolar molecules when all other factors (mass, temperature, etc) are held constant.

_____

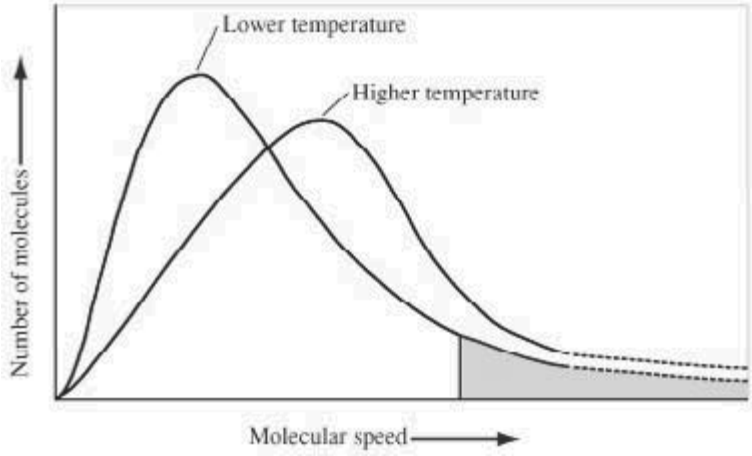
_____

_____

6. _____ The two gases in the figure below are simultaneously injected into opposite ends of the tube. The ends are then sealed. They should just begin to mix closest to which labeled point?



7. Explain the difference in the speed-distribution curves of a gas at the two temperatures shown in the figure below.



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Name:_____ Class: _____ Date: _____

CHAPTER 10 REVIEW

States of Matter

SECTION 2

SHORT ANSWER Answer the following questions in the space provided.

1. _____ Liquids possess all the following properties *except*
   (a) relatively low density.
   (b) the ability to diffuse.
   (c) relative incompressibility.
   (d) the ability to change to a gas.

2. a. Chemists distinguish between intermolecular and intramolecular forces. Explain the difference between these two types of forces.

_____

_____

Classify each of the following as intramolecular or intermolecular:

_____ b. hydrogen bonding in liquid water

_____ c. the O—H covalent bond in methanol, CH_3OH

_____ d. the bonds that cause gaseous Cl_2 to become a liquid when cooled

3. Explain the following properties of liquids by describing what is occurring at the molecular level.

   a. A liquid takes the shape of its container but does not expand to fill its volume.

_____

_____

_____

_____

   b. Polar liquids are slower to evaporate than nonpolar liquids.

_____

_____

_____

SECTION 2 *continued*

4. Explain briefly why liquids tend to form spherical droplets, decreasing surface area to the smallest size possible.

_____

_____

_____

_____

5. Is freezing a chemical change or a physical change? Briefly explain your answer.

_____

_____

_____

_____

6. Is evaporation a chemical or physical change? Briefly explain your answer.

_____

_____

_____

_____

7. What is the relationship between vaporization and evaporation?

_____

_____

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_____

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CHAPTER 10 REVIEW

States of Matter

SECTION 3

SHORT ANSWER Answer the following questions in the space provided.

1. Match description on the right to the correct crystal type on the left.

_____ ionic crystal	(a) has mobile electrons in the crystal
_____ covalent molecular crystal	(b) is hard, brittle, and nonconducting
_____ metallic crystal	(c) typically has the lowest melting point of the four crystal types
_____ covalent network crystal	(d) has strong covalent bonds between neighboring atoms

2. For each of the four types of solids, give a specific example other than one listed in the text.

_____

_____

_____

_____

_____

_____

3. A chunk of solid lead is dropped into a pool of molten lead. The chunk sinks to the bottom of the pool. What does this tell you about the density of the solid lead compared with the density of the molten lead?

_____

4. Answer *amorphous solid* or *crystalline solid* to the following questions:

_____ a. Which is less compressible?

_____ b. Which has a more clearly defined shape?

_____ c. Which is sometimes described as a supercooled liquid?

_____ d. Which has a less clearly defined melting point?

SECTION 3 *continued*

5. Explain the following properties of solids by describing what is occurring at the atomic level.
   a. Metallic solids conduct electricity well, but covalent network solids do not.

   _____

   _____

   _____

   _____

   b. The volume of a solid changes only slightly with a change in temperature or pressure.

   _____

   _____

   _____

   _____

   c. Amorphous solids do not have a definite melting point.

   _____

   _____

   _____

   _____

   d. Ionic crystals are much more brittle than covalent molecular crystals.

   _____

   _____

   _____

   _____

6. Experiments show that it takes 6.0 kJ of energy to melt 1 mol of water ice at its melting point but only about 1.1 kJ to melt 1 mol of methane, CH_4, at its melting point. Explain in terms of intermolecular forces why it takes so much less energy to melt the methane.

   _____

   _____

   _____

   _____

   _____

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CHAPTER 10 REVIEW

States of Matter

SECTION 4

SHORT ANSWER Answer the following questions in the space provided.

1. _____ When a substance in a closed system undergoes a phase change and the system reaches equilibrium,
   (a) the two opposing changes occur at equal rates.
   (b) there are no more phase changes.
   (c) one phase change predominates.
   (d) the amount of substance in the two phases changes.

2. Match the following definitions on the right with the words on the left.

_____ Equilibrium	(a) melting
_____ volatile	(b) opposing changes occurring at equal rates in a closed system
_____ fusion	(c) readily evaporated
_____ deposition	(d) a change directly from a gas to a solid

3. Match the process on the right with the change of state on the left.

_____ solid to gas	(a) melting
_____ liquid to gas	(b) condensation
_____ gas to liquid	(c) sublimation
_____ solid to liquid	(d) vaporization

4. Refer to the phase diagram for water in Figure 16 on page 347 of the text to answer the following questions:

_____ a. What point represents the conditions under which all three phases can coexist?

_____ b. What point represents a temperature above which only the vapor phase exists?

_____ c. Based on the diagram, as the pressure on the water system increases, what happens to the melting point of ice?

d. What happens when water is at point A on the curve and the temperature increases while the pressure is held constant?

_____

SECTION 4 *continued*

5. Use this general equilibrium equation to answer the following questions:

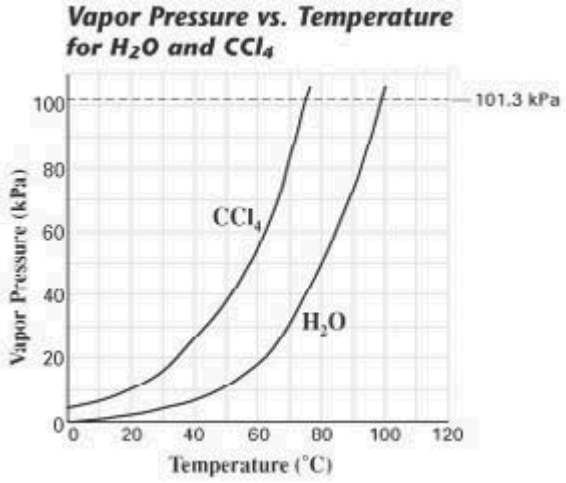
reactants $\rightleftarrows$ products + energy

_____ a. If the forward reaction is favored, will the concentration of reactants increase, decrease, or stay the same?

_____ b. If extra product is introduced, which reaction will be favored?

_____ c. If the temperature of the system decreases, which reaction will be favored?

6.Refer to the graph below to answer the following questions:



_____ a. What is the normal boiling point of CCl_4?

_____ b. What would be the boiling point of water if the air pressure over the liquid were reduced to 60 kPa?

_____ c. What must the air pressure over CCl_4 be for it to boil at 50°C?

d. Although water has a lower molar mass than CCl_4, it has a lower vapor pressure when measured at the same temperature. What makes water vapor less volatile than CCl_4?

_____

_____

_____

_____

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CHAPTER 10 REVIEW

States of Matter

SECTION 5

SHORT ANSWER Answer the following questions in the space provided.

1. Indicate whether each of the following is a *physical* or *chemical* property of water.

   _____ a. The density of ice is less than the density of liquid water.

   _____ b. A water molecule contains one atom of oxygen and two atoms of hydrogen.

   _____ c. There are strong hydrogen bonds between water molecules.

   _____ d. Ice consists of water molecules in a hexagonal arrangement.

2. Compare a polar water molecule with a less-polar molecule, such as formaldehyde, CH_2O. Both are liquids at room temperature and 1 atm pressure.

   _____ a. Which liquid should have the higher boiling point?

   _____ b. Which liquid is more volatile?

   _____ c. Which liquid has a higher surface tension?

   _____ d. In which liquid is NaCl, an ionic crystal, likely to be more soluble?

3. Describe hydrogen bonding as it occurs in water in terms of the location of the bond, the particles involved, the strength of the bond, and the effects this type of bonding has on physical properties.

_____

_____

_____

_____

_____

_____

_____

SECTION 5 *continued*

PROBLEMS Write the answer on the line to the left. Show all your work in the space provided.

4. The molar enthalpy of vaporization of water is 40.79 kJ/mol, and the molar enthalpy of fusion of ice is 6.009 kJ/mol. The molar mass of water is 18.02 g/mol.

_____ a. How much energy is absorbed when 30.3 g of liquid water boils?

_____ b. An energy unit often encountered is the calorie (4.18 J = 1 calorie). Determine the molar enthalpy of fusion of ice in calories per gram.

5. A typical ice cube has a volume of about 16.0 cm^3 . Calculate the amount of energy needed to melt the ice cube. (Density of ice at 0.°C = 0.917 g/mL; molar enthalpy of fusion of ice = 6.009 kJ/mol; molar mass of H_2O = 18.02 g/mol.)

_____ a. Determine the mass of the ice cube.

_____ b. Determine the number of moles of H_2O present in the sample.

_____ c. Determine the number of kilojoules of energy needed to melt the ice cube.