Chapter 10 Questions

Section 10.1

1) List the three states of matter in order of
a) increasing molecular disorder
b) increasing intermolecular attractions
c) increasing kinetic energy

2) Which type of intermolecular attractive force operates between
a) all molecules
b) polar molecules
c) the hydrogen atom of a polar bond and a nearby small, electronegative atom?

3) Consider the following substances: Ar, $CHCl_3$, NH_3. Which has
a) the largest London dispersion forces
b) the largest hydrogen bonding forces
c) no dipole-dipole forces
d) highest boiling point
e) lowest freezing point

4) What is the name of the process in which
a) a liquid turns into a gas
b) a gas goes directly to the solid phase
c) a solid becomes a liquid

5) Describe the intermolecular forces that hold together the following substances as liquids:
a) Br_2
b) CH_3OH
c) PH_3
d) H_2S
e) CO_2
f) OF_2

6) What kind of attractive forces must be overcome to
a) melt ice
b) boil HCl
c) sublime I_2
d) vaporize CH_3Cl
e) melt CCl_4
f) vaporize CH_2O
g) sublime CS_2
h) boil NBr_3

7) Which member of the following pairs has the larger London dispersion forces?
a) H_2O or H_2S
b) N_2 or O_2
c) CH_4 or CCl_4
d) CH_3Cl or CH_3Br
e) CH_3CH_2Cl or $CH_3CH_2CH_2Cl$
f) $CH_3CH_2CH_2Cl$ or $(CH_3)_2CHCl$

Sections 10.2 & 10.8

8) For a given substance, the densities of the liquid and solid phases are usually very similar and very different from the density of the gas. Explain.

9a) How do the viscosity and surface tension of liquids change as intermolecular forces become stronger?
b) How do the viscosity and surface tension of liquids change as temperature increases?

10) Name the phase transition in each of the following situations, and indicate whether it is exothermic or endothermic:
a) Bromine vapor turns to bromine liquid as it is cooled
b) moth balls gradually get smaller as they sit in a drawer
c) rubbing alcohol in an open container slowly disappears
d) molten lava from a volcano turns into solid rock.

11) Explain how each of the following affects the vapor pressure of a liquid:
a) volume of the liquid
b) surface area
c) intermolecular attractive forces
d) temperature.

12) Explain how stronger (or more) intermolecular forces affect
a) boiling point
b) viscosity
c) surface tension
d) vapor pressure

13) Based on the intermolecular forces holding a substance together, determine and expain which would have a higher physical property:
a) boiling point HCl or HF
b) viscosity of CH_4 or C_4H_{10}
c) surface tension of liquid PH_3 or Br_2
d) boiling point of O_2, CH_3CH_2OH or PF_3
e) vapor pressure of N_2, Ar, CH_2F_2, or CH_3NH_2

14a) What is the vapor pressure of a liquid, and how is it measured?
b) Explain why the boiling point of a liquid varies substantially with pressure, whereas the melting point of a solid depends little on pressure.

15) Phosphorus trichloride, PCl_3 is more volatile than arsenic trichloride, $AsCl_3$, at $25^{O}C$.
a) Which substance has the greater intermolecular forces? Explain.
b) Which substance has the higher vapor pressure at 25 °C?
c) Which substance will have the higher boiling point?

Section 10.9

16) Why does increasing the temperature cause a substance to change in succession from a solid to a liquid to a gas?

17) Explain why compressing a gas at constant temperature can cause it to liquify.

18) Refer to Figure 10.47 (pg. 491), and describe all the phase changes that would occur in each of the following cases:
a) Water vapor originally at 1.0×10^{-3} atm and -0.10 °C is slowly compressed at constant temperature until the final pressure is 10 atm
b) Water originally at 100.0 °C and 0.50 atm is cooled at constant pressure until the temperature is -10.0 °C

19) Refer to Figure 10.50 (pg. 495), and describe the phase changes (and the temperatures at which they occur) when CO_2 is heated from -80 °C to -20 °C at
a) a constant pressure of 3 atm
b) a constant pressure of 6 atm

20) The normal melting and boiling points of xenon are -112 °C and –107 °C, respectively. Its triple point is at -121 °C and 282 torr, and its critical point is at 16.6 °C and 57.6 atm.
a) Sketch the phase diagram for Xe, showing the four points given above and indicating the area in which each phase is stable.
b) Which is denser, Xe (s) or Xe (l)? Explain.
c) If Xe gas is cooled under an external pressure of 100 torr, will it undergo condensation or deposition? Explain.

21) The normal melting and boiling points of O_2 are -218 °C and -183 °C, respectively. Its triple point is at -219 °C and 1.14 torr, and its critical point is at -119 °C and 49.8 atm.
a) Sketch the phase diagram for O_2, showing the four points given above and indicating the area in which each phase is stable.
b) Will O_2 (s) float on O_2 (l)? Explain.
c) As it is heated, will solid O_2 sublime or melt under a pressure of 1 atm?

Sections 10.3 – 10.6

22) How does an amorphous solid differ from a crystalline one?

23) Amorphous silica has a density of 2.2 g/cm^3, whereas the density of crystalline quartz is 2.65 g/cm^3. Account for this difference in densities.

24) What kind of attractive forces exist between particles in
a) molecular crystals
b) covalent-network crystals
c) ionic crystals
d) metallic crystals

24) Indicate the type of crystal each of the following would form upon solidification:
a) Zr
b) N_2O_4
c) Si
d) Ne
e) $Ni(ClO_3)_2$
f) para-dichlorobenzene
g) KCl
h) ClO_2
i) C
j) Al

25) Covalent bonding occurs in both molecular and covalent-network solids. Why do these two kinds of solids differ so greatly in their hardness and melting points?

26) If the particles in both molecular and metallic solids are both atoms, why do they differ so greatly in their physical properties?

Review

1) What is the pH of a solution of when 10.0 mL of a 0.50 M solution of $HClO_2$ is neutralized to its equivalence point with 0.10 M NaOH?

2) Determine the empirical formula and molecular formula of ibuprofen, which is made of 75.69% C, 8.80% H and 15.51% O by mass and a molar mass of 206 g/mol.

3) Write the electron configuration for Sn and explain why it is smaller than Ba.

4) Write the net ionic equations for the following combinations:
a) aqueous calcium chloride and aqueous lead (II) nitrate
b) aqueous hydrobromic acid and aqueous strontium hydroxide
c) solid tin and aqueous hydrochloric acid

5) Draw a Lewis structure for BrF_4^-, then determine shape, molecule polarity and hybridization.