Chemistry I
Problem Set X
Chapter 11

Due: Monday, 18-December-2006 by 4:00 p.m. so I can grade it and get it back to you to
use to study for the final exam.

1) Metallic barium has a body-centered cubic structure (all atoms at the lattice points) and
a density of 3.51 g/cm$^3$. Assume the barium atoms to be spheres. The spheres in a body-
centered array occupy 68.0% of the total space. Find the atomic radius of barium.

2) In an experiment, a sample of 6.75 L of nitrogen at 26.0°C and 768 mm Hg is bubbled
through liquid acetone, C$_3$H$_6$O. The gas plus vapor at its equilibrium vapor pressure
leaves the liquid at the same temperature and pressure. If 6.650 g of acetone has
evaporated, what is the vapor pressure of acetone at 26.0°C?

3) How much heat is needed to vaporize 20.0 mL of liquid ethanol, C$_2$H$_5$OH, at 25.0°C?
The density of the liquid is 0.7893 g/mL. You may need to collect standard heats of
formation from your textbook.

4) The total pressure over liquid acetic acid, CH$_3$COOH, at 71.3°C is 146 mm Hg, and is
composed of a mixture of monomers and dimers. (A dimer is a molecule formed by two
simpler molecules coming together.) If the density of the vapor is 0.702 g/L, what is the
mole fraction of the dimer in the vapor? The dimer has the structure:

5) Explain the following: You add 100 mL of water to a 500 mL flask and heat the water
until it is boiling. You remove the heat and stopper the flask, and the boiling stops. You
then run cool water over the neck of the flask and the boiling begins again. It seems as
though you are boiling water by cooling it.