## Practice Problems

1. Let’s play with the isobaric coefficient of volume expansion for water. If the liquid is kept at constant pressure, calculate the percent increase in the volume of a liquid that started at 50 °F and is heated until 212 °F (and still liquid). For this calculation, assume the isobaric coefficient remains constant over this temperature range.
2. Let’s play with a combination of the isobaric isothermal coefficients. You are going to pressurize mercury (the substance, not the planet) from 14.7 psia to 1000 psia. You want to keep it the same density throughout the whole process. If the initial temperature of the mercury is 70 °F, what temperature must it be heated to when it is under 1000 psia of pressure? Use information from Table 3.2 to help out.
3. Let’s draw a picture! In the preparatory reading questions in the last homework you sketched a phase diagram (p-T) for water. For this homework, I want you to sketch a p-*v* diagram for water. This will be similar to Figure 3.15a in your text (but much less messy). Use pressure in units of kPa on the vertical axis, and specific volume in units of m3/kg on the horizontal axis. Sketch this on log-log coordinates. Along with the shape of the dome, include the following:

* Isotherms at 600 °C, 374 °C, 300 °C, 100 °C, 50 °C, and 0 °C
* Label the critical point, the triple point line, and both saturated liquid and vapor lines
* Label regions of compressed liquid, two-phase mixture, and superheated vapor
* Shade in and label the regions for gas (above critical temperature, but below critical pressure), and supercritical fluid (above critical pressure and temperature)

## Preparatory Reading Questions

1. For each of the following thermodynamic quantities, identify:
   1. The variables (symbol)
   2. The SI unit
   3. English units
   4. Fundamental MLt dimensions

**Quantities:** isobaric coefficient of volume expansion, isothermal coefficient of compressibility, isochoric heat capacity, isobaric heat capacity

1. What assumptions and procedures are used to determine thermodynamic properties of incompressible materials?
2. What assumptions and procedures are used to determine thermodynamic properties of ideal gases with constant heat capacities?

## Answers to Practice Problems

1. ~1.863 \* 10-3 %
2. ~2768 °F (or 3227 °R)
3. Rework the figure in the text to show more clearly the bullet points asked for in the problem statement. This picture doesn’t have to be super accurate. It’s intended to help you understand the difference between things like: how are a superheated vapor and a gas different?