**SQUEEZING WATER**

**GIVEN**: Liquid water experiences an isothermal compression where the pressure increases by 100,000 psia. The value of the isothermal coefficient of compression remains constant during this process.



**FIND**: The percent decrease in the volume of the water for this process.

**SOLUTION**: From *v* = *v*(*p*,*T*) and the definition of ** and **, we know that,



Since the process is isothermal, *dT* = 0. Therefore,



The value of k is considered to be constant (given in the problem statement). Therefore, the integration of the above equation between any two states is,



The percent decrease in the volume due to the increased pressure can be found by,



From Table 3.2, ** = 2200 x 10-11 ft2/lbf. Therefore the percent decrease in the water volume is,



**REFLECTION**:

* Wow! The water experiences a significant decrease in volume. However, when we consider the excessive pressure increase (100,000 psia ~ 6800 atm), this seems reasonable.
* If the pressure increase were smaller, say 100 psia, then the percent decrease in the water volume turns out to be 0.032%. This tells us that if the pressure change is reasonably small, then the water can be considered an *incompressible* substance.
* Something to think about: Does the isothermal compressibility really remain constant in this process? What if it varied as a function of *p* and *T* ?