Physics 317

Homework #3 – ***Due in class, Wed Sep 28***

1. Consider Dietericci's expression for pressure $P(T,V) = \frac{RT}{V-b} e^{-a/RTV}$. Find the critical volume and temperature by solving the equations, $\frac{\partial P}{\partial V} = 0 = \frac{\partial^2 P}{\partial V^2}$

2. A hypothetical substance has volumetric thermal expansion coefficient $\beta = bT/v$ and compressibility $\kappa = a/(Pv)$. Find a formula for its equation of state.

3. Heat *Q* is added to a monatomic ideal gas in an isochoric, *i.e.,* constant volume, process, resulting in a temp change of ΔT. How much heat would be required to produce the same temp change in an isobaric process? *Hint: use the difference between the two different specific heat capacities.*

4. Write down a formula for the work done by an adiabatic process as it goes from an initial state *"i"* to a final state *"f."*

5. Baierlein p. 47, #3

6. Baierlein p. 47 #4

7. Repeat Baierlein p. 47 #4 but to get ballpark estimates for four US coins:
    a. Penny. How does your answer compare to the solution to problem #6?
    b. Nickel
    c. Dime
    d. Quarter

    For the purposes of this exercise, use the latent heat values listed at http://www.engineeringtoolbox.com/latent-heat-melting-solids-d_96.html, and properties of coins at http://www.cengage.com/chemistry/book_content/0547125321_zumdahl/chemical_connections/Zumdahl.8e.Ch21.CI02.pdf and simply assume that the latent heat of the coin metal is the weighted average of the latent heats of constituent metals.

8. Baierlein #7 a-c, *but* with T=310 K (body temp) and V=1 L and V_{vac} = 0.5 L.

as of 5:50 AM on 9/23/16