

ME/CH EN 2300  
Thermodynamics I

Homework #1

1. (!-2) Why does a bicyclist pick up speed on a downhill road even when he is not pedaling? Does this violate the conservation of energy principle?
2. (1-10) At  $45^\circ$  latitude, the gravitational acceleration as a function of elevation  $z$  above sea level is given by  $g = a - bz$ , where  $a = 9.807 \text{ m/s}^2$  and  $b = 3.32 \times 10^{-6} \text{ s}^{-2}$ . Determine the height above sea level where the weight of an object will decrease by 1 percent.
3. (1-16) You have been asked to do a metabolism (energy) analysis of a person. How would you define the system for this purpose? What type of system is this?
4. (1-20) What is the difference between intensive and extensive properties?
5. (1-22) Is the number of moles of a substance contained in a system an extensive or intensive property?
6. (1-34) Consider a system whose temperature is  $18^\circ\text{C}$ . Express this temperature in R, K and  $^\circ\text{F}$ .
7. (1-45) The maximum safe air pressure of a tire is typically written on the tire itself. The label on a tire indicates that the maximum pressure is 35 psi (gage). Express this maximum pressure in kPa.
8. (1-58) Consider a 70-kg woman who has a total foot imprint area of  $400 \text{ cm}^2$ . She wished to walk on snow, but the snow cannot withstand pressures greater than 0.5 kPa. Determine the minimum size of the snowshoe needed (imprint area of snowshoe) to enable her to walk on the snow without sinking.
9. (1-59) A vacuum gage connected to a tank reads 15 kPa at a location where the barometric pressure reading is 750 mm Hg. Determine the absolute pressure in the tank. Take  $\rho_{\text{Hg}} = 13,590 \text{ kg/m}^3$ .