2.7: Chapter 2 Problems

2.1

Let X represent the quantity V^2 with dimensions $(\text{length})^6$. Give a reason that X is or is not an extensive property. Give a reason that X is or is not an intensive property.

2.2

Calculate the *relative uncertainty* (the uncertainty divided by the value) for each of the measurement methods listed in Table 2.2, using the typical values shown. For each of the five physical quantities listed, which measurement method has the smallest relative uncertainty?

Table 2.5 Helium at a fixed temperature

$(1/V_m)/10^2\,\text{mol}\,\text{m}^{-3}$	$(p_2V_m/R)/K$
1.0225	2.7106
1.3202	2.6994
1.5829	2.6898
1.9042	2.6781
2.4572	2.6580
2.8180	2.6447
3.4160	2.6228
3.6016	2.6162
4.1375	2.5965
4.6115	2.5790
5.1717	2.5586

2.3

Table 2.5 lists data obtained from a constant-volume gas thermometer containing samples of varying amounts of helium maintained at a certain fixed temperature T_2 in the gas bulb (K. H. Berry, *Metrologia*, **15**, 89–115, 1979). The molar volume V_m of each sample was evaluated from its pressure in the bulb at a reference temperature of $T_1 = 7.1992\,\text{K}$, corrected for gas nonideality with the known value of the second virial coefficient at that temperature.

Use these data and Eq. 2.2.2 to evaluate T_2 and the second virial coefficient of helium at temperature T_2. (You can assume the third and higher virial coefficients are negligible.)

2.4

Discuss the proposition that, to a certain degree of approximation, a living organism is a steady-state system.

2.5

The value of ΔU for the formation of one mole of crystalline potassium iodide from its elements at $25\,^\circ\text{C}$ and 1 bar is $-327.9\,\text{kJ}$. Calculate Δm for this process. Comment on the feasibility of measuring this mass change.