Dimensional Reasoning

Things you should learn:

1. How dimensions, units, and magnitudes characterize physical variables/measurement.
2. That a limited number of primitive dimensions can be arranged to characterize all physical phenomena
3. Dimensions are intrinsic to the variables themselves; units are not
4. Measurement and quantification of variables depend on units which are established by convention, e.g., SI
5. Rudiments of the SI and English measurement systems
6. Why we still use more than one system of units
7. Dimensions, units, and quantities may be manipulated algebraically
8. All terms in an equation must have identical primitive dimensions to be consistent
9. Many physical phenomena can be expressed in terms of its contributing parameters as a single term
10. Dimensional reasoning can be used to infer the relationship between those parameters
11. What are "dimensionless" variables
12. Why physical phenomena are sometimes expressed in terms of dimensionless variables
13. Descriptions of and differences between geometric, kinematic, and dynamic similarity
14. Why old movies look "strange" when movie-makers use models to simulate disasters
15. When scale models can be used to predict full-size phenomena. When they can't.

Things you should be able to do:

1. Confirm the dimensional consistency of an equation
2. Convert expressions from one set of units to another
3. Deduce the relationship between parameters characterizing a simple physical process using dimension reasoning
4. Give examples of non-dimensional variables
5. Infer which terms in a non-dimensional equation may be neglected

Things you should be lying awake at night thinking about:

1. Why do animals look the way they do, i.e., why to ants have skinny legs, and elephants have fat legs?
2. What would animals look like if they lived on a planet whose gravity were ten times that of earth?