1.4 Perform the following unit conversions:

(a) 1 L to in.³
(b) 650 J to Btu
(c) 0.135 kW to ft · lbf/s
(d) 378 g/s to lb/min
(e) 304 kPa to lbf/in.²
(f) 55 m³/h to ft³/s
(g) 50 km/h to ft/s
(h) 8896 N to ton (= 2000 lbf)

1.5 Perform the following unit conversions:

(a) 122 in.³ to L
(b) 778.17 ft · lbf to kJ
(c) 100 hp to kW
(d) 1000 lb/h to kg/s
(e) 29.392 lbf/in.² to bar
(f) 2500 ft³/min to m³/s
(g) 75 mile/h to km/h
(h) 1 ton (= 2000 lbf) to N

1.8 A gas occupying a volume of 25 ft³ weighs 3.5 lbf on the moon, where the acceleration of gravity is 5.47 ft/s². Determine its weight, in lbf, and density, in lb/ft³, on Mars, where \( g = 12.86 \text{ ft/s}^2 \).

1.12 A spring compresses in length by 0.14 in. for every 1 lbf of applied force. Determine the mass of an object, in pounds mass, that causes a spring deflection of 1.8 in. The local acceleration of gravity = 31 ft/s².

1.21 A spherical balloon holding 35 lb of air has a diameter of 10 ft. For the air, determine (a) the specific volume, in ft³/lb and ft³/lbmol, and (b) the weight, in lbf. Let \( g = 31.0 \text{ ft/s}^2 \).

1.49 Figure P1.49 shows a closed tank holding air and oil to which is connected a U-tube mercury manometer and a pressure gage. Determine the reading of the pressure gage, in lbf/in.² (gage). The densities of the oil and mercury are 55 and 845, respectively, each in lb/ft³. Let \( g = 32.2 \text{ ft/s}^2 \).
2.4 A 2.5 × 3.5 × 6 in. brick whose density is 120 lb/ft³ slips off the top of a building under construction and falls 69 ft. For \( g = 32.0 \text{ ft/s}^2 \), determine the change in gravitational potential energy of the brick, in ft · lb. 

2.9 Vehicle crumple zones are designed to absorb energy during an impact by deforming to reduce transfer of energy to occupants. How much kinetic energy, in Btu, must a crumple zone absorb to fully protect occupants in a 3000-lb vehicle that suddenly decelerates from 10 mph to 0 mph?

2.16 Beginning from rest, an object of mass 200 kg slides down a 10-m-long ramp. The ramp is inclined at an angle of 40° from the horizontal. If air resistance and friction between the object and the ramp are negligible, determine the velocity of the object, in m/s, at the bottom of the ramp. Let \( g = 9.81 \text{ m/s}^2 \).

2.24 Measured data for pressure versus volume during the expansion of gases within the cylinder of an internal combustion engine are given in the table below. Using data from the table, complete the following:

(a) Determine a value of \( n \) such that the data are fit by an equation of the form, \( pV^n = \text{constant} \).
(b) Evaluate analytically the work done by the gases, in kJ, using Eq. 2.17 along with the result of part (a).
(c) Using graphical or numerical integration of the data, evaluate the work done by the gases, in kJ.
(d) Compare the different methods for estimating the work used in parts (b) and (c). Why are they estimates?

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<th>Data Point</th>
<th>( p ) (bar)</th>
<th>( V ) (cm³)</th>
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