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Getting Started

Introductory Concepts and Definitions

PROBLEM 1.4

(a) $1\ \text{L}\left|\frac{0.0353\ \text{ft}^3}{1\ \text{L}}\right|\left|\frac{12\ \text{in.}}{1\ \text{ft}}\right|^3 = 61\ \text{in}^3$ ←

(b) $650\ \text{J}\left|\frac{1\ \text{kJ}}{10^3\ \text{J}}\right|\left|\frac{1\ \text{Btu}}{1.0551\ \text{kJ}}\right| = 0.616\ \text{Btu}$ ←

(c) $0.135\ \text{kW}\left|\frac{3413\ \text{Btu/h}}{1\ \text{kW}}\right|\left|\frac{1\ \text{h}}{3600\ \text{s}}\right|\left|\frac{778.17\ \text{ft}\cdot\text{lbf}}{1\ \text{Btu}}\right| = 99.596\ \frac{\text{ft}\cdot\text{lbf}}{\text{s}}$ ←

(d) $378\ \frac{\text{g}}{\text{s}}\left|\frac{1\ \text{kg}}{10^3\ \text{g}}\right|\left|\frac{1\ \text{lb}}{0.4536\ \text{kg}}\right|\left|\frac{60\ \text{s}}{1\ \text{min}}\right| = 50\ \frac{\text{lb}}{\text{min}}$ ←

(e) $304\ \text{kPa}\left|\frac{1\ \text{lbf/in}^2}{6894.8\ \text{Pa}}\right|\left|\frac{10^3\ \text{Pa}}{1\ \text{kPa}}\right| = 44.09\ \text{lbf/in}^2$ ←

(f) $55\ \frac{\text{m}^3}{\text{h}}\left|\frac{3.2808\ \text{ft}}{1\ \text{m}}\right|^3\left|\frac{1\ \text{h}}{3600\ \text{s}}\right| = 0.54\ \frac{\text{ft}^3}{\text{s}}$ ←

(g) $50\ \frac{\text{km}}{\text{h}}\left|\frac{10^3\ \text{m}}{1\ \text{km}}\right|\left|\frac{3.2808\ \text{ft}}{1\ \text{m}}\right|\left|\frac{1\ \text{h}}{3600\ \text{s}}\right| = 45.57\ \frac{\text{ft}}{\text{s}}$ ←

(h) $8896\ \text{N}\left|\frac{1\ \text{lbf}}{4.4482\ \text{N}}\right|\left|\frac{1\ \text{ton}}{2000\ \text{lbf}}\right| = 1\ \text{ton}$ ←

PROBLEM 1.5

(a) $122\ \text{in}^3\left|\frac{1\ \text{cm}^3}{0.061024\ \text{in}^3}\right|\left|\frac{1\ \text{m}}{10^2\ \text{cm}}\right|^3\left|\frac{1\ \text{L}}{10^{-3}\ \text{m}^3}\right| = 2\ \text{L}$ ←

(b) $778.17\ \text{ft}\cdot\text{lbf}\left|\frac{1\ \text{kJ}}{737.56\ \text{ft}\cdot\text{lbf}}\right| = 1.0551\ \text{kJ}$ ←

(c) $100\ \text{hp}\left|\frac{1\ \text{kW}}{1.341\ \text{kW}}\right| = 74.57\ \text{kW}$ ←

(d) $1000\ \frac{\text{lb}}{\text{h}}\left|\frac{1\ \text{h}}{3600\ \text{s}}\right|\left|\frac{1\ \text{kg}}{2.2046\ \text{lb}}\right| = 0.126\ \frac{\text{kg}}{\text{s}}$ ←

PROBLEM 1.5 (Continued)

(e) $29.392 \frac{lbf}{in^2} \left| \frac{6894.8\ Pa}{1\ lbf/in^2} \right| \left| \frac{1\ N/m^2}{1\ Pa} \right| \left| \frac{1\ bar}{10^5\ N/m^2} \right| = 2.027\ bar$ ←

(f) $2500 \frac{ft^3}{min} \left| \frac{0.028317\ m^3}{1\ ft^3} \right| \left| \frac{1\ min}{60s} \right| = 1.18 \frac{m^3}{s}$ ←

(g) $75 \frac{mile}{h} \left| \frac{1.6093\ km/h}{1\ mile/h} \right| = 120.7\ km/h$ ←

(h) $1\ ton \left| \frac{2000\ lbf}{1\ ton} \right| \left| \frac{4.4482\ N}{1\ lbf} \right| = 8896\ N$ ←

PROBLEM 1.6

(a) $F_{grav} = mg = (100\ kg)(25 \frac{m}{s^2}) \left| \frac{1\ N}{1\ kg \cdot m/s^2} \right| = 2500\ N$ ← F_{grav}

(b) Mass value remains the same. So, on Earth

$F_{grav} = mg = (100\ kg)(9.81 \frac{m}{s^2}) \left| \frac{1\ N}{1\ kg \cdot m/s^2} \right| = 981\ N$ ← F_{grav}

PROBLEM 1.7

(a) $g = \frac{F_{grav}}{m} = \frac{144.4\ lbf}{150\ lb} \left| \frac{32.174\ lb \cdot ft/s^2}{1\ lbf} \right| = 30.97 \frac{ft}{s^2}$ ← g

(b) Mass value remains the same. So

$F_{grav} = mg = (150\ lb)(32.174\ ft/s^2) \left| \frac{1\ lbf}{32.174\ lb \cdot ft/s^2} \right| = 150\ lbf$ ← F_{grav}
