

78. See Appendix C. We note that, since  $v = 2\pi r/T$ , the centripetal acceleration may be written as  $a = 4\pi^2 r/T^2$ . To express the result in terms of  $g$ , we divide by  $9.8 \text{ m/s}^2$ .

(a) The acceleration associated with Earth's spin ( $T = 24 \text{ h} = 86400 \text{ s}$ ) is

$$a = g \frac{4\pi^2 (6.37 \times 10^6 \text{ m})}{(86400 \text{ s})^2 (9.8 \text{ m/s}^2)} = 0.0034g .$$

(b) The acceleration associated with Earth's motion around the Sun ( $T = 1 \text{ y} = 3.156 \times 10^7 \text{ s}$ ) is

$$a = g \frac{4\pi^2 (1.5 \times 10^{11} \text{ m})}{(3.156 \times 10^7 \text{ s})^2 (9.8 \text{ m/s}^2)} = 0.00061g .$$

(c) The acceleration associated with the Solar System's motion around the galactic center ( $T = 2.5 \times 10^8 \text{ y} = 7.9 \times 10^{15} \text{ s}$ ) is

$$a = g \frac{4\pi^2 (2.2 \times 10^{20} \text{ m})}{(7.9 \times 10^{15} \text{ s})^2 (9.8 \text{ m/s}^2)} = 1.4 \times 10^{-11}g .$$