

Circular Motion and Gravity EOC

$$6. \frac{3600 \text{ rev}}{1 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ sec}} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} = 376.9911184 \text{ rad/s}$$

$$\omega^2 = \omega_0^2 + 2\alpha \Delta\theta$$

$$0 = 376.9911184^2 + 2\alpha \left(50 \text{ rev} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} \right)$$

$$= 376.9911184^2 + 200\pi\alpha$$

$$-376.9911184^2 = 200\pi\alpha$$

$$\alpha = \frac{376.9911184^2}{200\pi}$$

$$200\pi$$

$$\alpha = 226.1946711 \text{ rad/s}^2$$

$$19. a) F = ma$$

$$F = m \frac{v^2}{R}$$

$$F = 55 \times \frac{R^2}{0.8}$$

$$F = 1100 \text{ N}$$

$$b) \text{ her weight} = mg$$

$$= 55 \times 9.8$$

$$= 539 \text{ N}$$

$$1100 + 539 = 2.040816327$$

$$29. F_g = \frac{G m_1 m_2}{r^2} = \frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24} \times 3 \times 10^4}{384000 \times 1000^2}$$

$$= 324.5979818 \text{ N}$$

$$13. \theta = \omega t$$

$$37 \text{ rev} \times \frac{2\pi \text{ rad}}{1 \text{ rev}} = 74\pi \text{ rad}$$

$$\theta = \frac{\omega_0 + \omega}{2} t$$

$$74\pi = \frac{\omega_0 + 98}{2} (3)$$

$$\frac{74\pi \times 2}{3} - 98 = \omega_0$$

$$\omega_0 = 56.98523758 \text{ rad/s}$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$$

$$\theta - \theta_0 - \omega_0 t = \frac{1}{2} \alpha t^2$$

$$\frac{(\theta - \theta_0 - \omega_0 t) \times 2}{t^2} = \alpha$$

$$\alpha = \frac{(74\pi - 0 - 56.98523758 \times 3) \times 2}{3^2}$$

$$\alpha = 13.67158747 \text{ rad/s}^2$$

26.



$$F = ma$$

$$T - F_g = m \frac{v^2}{R}$$

$$T = m \frac{v^2}{R} + mg$$

$$T = 85 \times \frac{v^2}{10} + 85 \times 9.8$$

$$T = 1377N$$

If the wire breaks at 1000N, but Canyon exceeds 1377N it will break and he will not make it across

$$39. \omega^2 = \frac{Gmc}{r} \quad \omega = \sqrt{\frac{Gmc}{r}}$$

$$b) \quad \omega = \sqrt{\frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{200 \times 1000 + 6.38 \times 10^6}}$$

$$\omega = 7785.751931 \text{ m/s}$$

$$a) \quad 2\pi r = 2\pi \times (200 \times 1000 + 6.38 \times 10^6)$$

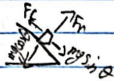
$$= 41\,343\,359.32 \text{ m}$$

$$\frac{41\,343\,359.32}{7785.751931} = 5\,310.130568 \text{ s}$$

$$5\,310.130568 \text{ s} \times \frac{1 \text{ h}}{3600 \text{ s}} = 1.475 \text{ h}$$



OR



a)

$$F \geq ma$$

$$F_c + mg \sin(\theta) \geq m \frac{v^2}{R}$$

$$F_c \mu + mg \sin(\theta) \geq m \frac{v^2}{R}$$

$$mg \cos(\theta) \mu + mg \sin(\theta) \geq m \frac{v^2}{R}$$

$$g(\cos(\theta) \mu + \sin(\theta)) \geq \frac{v^2}{R}$$

$$\omega \leq \sqrt{R(\cos(\theta) \mu + \sin(\theta))}$$

$$F \leq ma$$

$$-F_c + mg \sin(\theta) \leq m \frac{v^2}{R}$$

$$-F_c \mu + mg \sin(\theta) \leq m \frac{v^2}{R}$$

$$-mg \cos(\theta) \mu + mg \sin(\theta) \leq m \frac{v^2}{R}$$

$$g(-\cos(\theta) \mu + \sin(\theta)) \leq \frac{v^2}{R}$$

$$\omega \geq \sqrt{R(-\cos(\theta) \mu + \sin(\theta))}$$

$$b) \quad \omega \leq \sqrt{100 \times 9.8 (\cos(20) \times 0.1 + \sin(20))}$$

$$\omega \leq 16.33 \text{ m/s}$$

$$\omega \geq \sqrt{100 \times 9.8 (-\cos(20) \times 0.1 + \sin(20))}$$

$$\omega \geq 8.58 \text{ m/s}$$

$$35. \omega^2 = \frac{Gmc}{r} \quad r = \frac{Gmc}{\omega^2} \quad r = \frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{5000^2}$$

$$r = 15\,954\,640$$

$$15\,954\,640 - 6.38 \times 10^6 = \boxed{9\,574\,640 \text{ m}}$$

$$2\pi r = 2\pi \times 15\,954\,640$$

$$\frac{2\pi \times 15\,954\,640}{5000} = 20\,049.19193 \text{ s}$$

$$20\,049.19193 \text{ s} \times \frac{1 \text{ h}}{3600 \text{ s}} = \boxed{5.569 \text{ h}}$$