Homework Solutions
10/1/2007

Conceptual

6. Yes, you would weigh more at night when both the sun and the earth are pulling on you in the same direction. You would weigh even more during a new moon at night because then the moon, earth and sun are pulling on you in the same direction. You would weight less during the day of a new moon because then the sun and moon pull in a direction opposite of the earth.

7. The racing car rounds the turn at a constant speed of 90 miles per hour.

8. An astronaut in space feels weightless because there is no normal force supporting her/him.

Problems

20.

$$r = 0.15m$$

$$m = 3.0 \bullet 10^{-16} kg$$

$$F_{net} = 4.0 \bullet 10^{-11} N$$

$$F_c = \frac{mv^2}{r}$$

$$v = \sqrt{\frac{F_c r}{m}} = \sqrt{\frac{(4.0 \bullet 10^{-11} N)(0.15m)}{3.0 \bullet 10^{-16} kg}} = 141.42 \frac{m}{s}$$

$$\frac{141.42m}{1s} \bullet \frac{1rev}{2\pi(0.15m)} = 150 \frac{rev}{s}$$

23. a.

$$r = 2.00m$$

$$m = 50.0kg$$

$$\omega = 3.00\frac{rad}{s}$$

$$\frac{3.00rad}{s} \bullet \frac{(r)m}{1rad} = 6.00\frac{m}{s}$$

$$a_c = \frac{v^2}{r} = \frac{36.0\frac{m^2}{s^2}}{2.00m} = 18.0\frac{m}{s^2}$$

b.

$$F_c = \frac{mv^2}{r} = ma_c = 50.0kg\left(18.0\frac{m}{s^2}\right) = 900N$$

c.

$$F_s = \mu_s \eta$$

$$900N = \mu_s\left(50.0kg \bullet 9.8\frac{m}{s^2}\right)$$

$$\mu_s = 1.84$$

A coefficient of friction larger than 1 is not reasonable so she will succumb to Newton's First Law. Buh-bye!