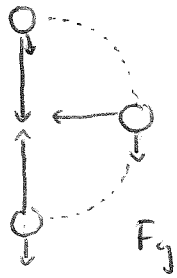
Test 2 Practice Answers

1.) $\frac{3 \text{ rev}}{\text{sec}} \left| \frac{2\pi(.8)\text{ m}}{1 \text{ rev}} \right. = \frac{15.08 \text{ m}}{\text{sec}}$

$a_c = \frac{v^2}{r} = 284 \text{ m/s}^2$

$F_c = ma_c = (.12)(284) = 34.11 \text{ N}$

2.)



$F_g = 1.2 \text{ N}$

Top = gravity does some force for you, only need 33 N of tension

S.de = 34.1 N of tension

Bottom = must pull harder to counter gravity, 35.3 N of tension

3.) $F_c = F_g = ma_c = mg \qquad a_c = 9.8 = \frac{v^2}{(.8)} = 2.8 \frac{\text{m}}{\text{s}}$

4.) $F = G\frac{m_1 m_2}{r^2} \qquad a = G\frac{m_1}{r^2} = \frac{(6.67\times10^{-11})(7.3\times10^{22})}{(1{,}737{,}000)^2} = 1.61 \frac{\text{m}}{\text{s}^2}$

roughly $\frac{1}{6}$ g

200 lbs on earth $\Rightarrow$ ~~$\frac{200}{9.8}$~~ $\frac{200}{9.8} \cdot \frac{1.6}{9.8} = 32.9 \text{ lbs } (146 \text{ N})$

$F = \frac{(6.67)}{\times10^{-11}} \frac{(6\times10^{24})(7.3\times10^{22})}{(3.844\times10^{8})^2} = 2\times10^{20} \text{ N}$ ← force on moon and force on earth

$F_c = ma_c = m\frac{v^2}{r} = 2\times10^{20} = (7.3\times10^{22})\frac{v^2}{(3.84\times10^{8})} \qquad v = 1020 \frac{\text{m}}{\text{s}}$

5.) If distance is doubled, F is decreased by factor of $\frac{1}{4}$

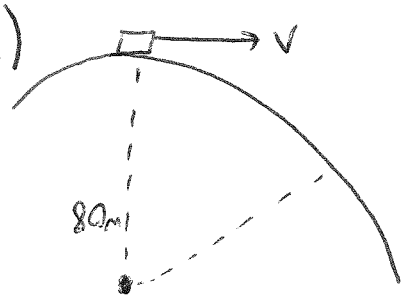
$F = \frac{1}{4}(10000) = 2500\ N$

mass of satellite = 1000 kg

$F_c = m a_c =$ ~~2.5~~

$2500 = 1000\, a_c$ $\quad a_c = 2.5\ \frac{m}{s^2}$ $\quad 2.5 = \frac{v^2}{(12{,}800)}$ $\quad v = 178.8\ \frac{m}{s^2}$

6.)



$\frac{70\ mi}{hr} \left| \frac{1\ hr}{3600\ s} \right| \frac{1600\ m}{1\ mi} = 31.1\ \frac{m}{s}$

$a_c = \frac{31.1^2}{80} = 12.1\ \frac{m}{s^2}$

Since a_c is greater than 9.8, there is not enough acceleration of gravity to keep the car on the road.

7.) Convection causes heat to rise. On the side of the candle, you only feel radiation heat

8.) A lot of heat is used to vaporized the water instead of flowing into your finger

9.) It is lower, if it starts to heat up, the heat will rise due to convection and cooler air will flow back down.

It is more shaded, less radiation will get to it to heat it up

It has more water which has higher specific heat and takes longer to heat.

Moisture in the air helps evaporation - a cooling process

10.) water at 22°C → water at °C → ice at °C

$Q = mc\Delta T$ + $Q = m\ell$

$= 500(1)(22) + (500)(80) =$ 51000 calories

11.) ice at °0°C → water at 0°C → equilibrium

Vapor at 100°C → Water at 100°C

$Q = m\ell + mc\Delta T = mc\Delta T + m\ell$

$(50)(80) + (50)(1)(x-0) = (123)(1)(100-x) + (3)(539)$

final temp x°C

$4000 + 50x = 12300 - 123x + 1617$

$173x = 9917$

$x = 57.32$ °C

12.) A metal pole is a good conductor of heat, heat will flow from your tongue quickly. Fast enough that the water might freeze (change phase)

13.) Layers "trap" warm air and prevent continued loss of heat through radiation since the layer of air around your body will also radiate heat back into you.

14.) Water has higher specific heat so warms up slower, or at night cools down slower. Since the land is cooler, the air above the land is cooler. Since the water is warmer, the air above it is warmer and will rise due to convection. Cooler air rushes to the water generating a breeze towards the water