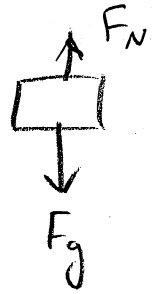
# Unit VIII: Worksheet 1

(1) 

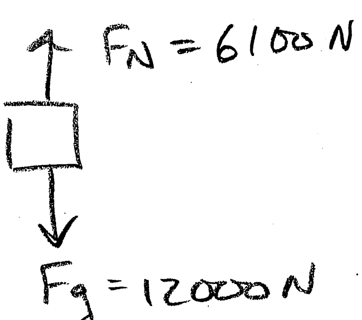
(constant speed, so dots are evenly spaced)

(2) Towards the center of the circular hill. When traveling a circular path, the acceleration is towards the center of the circle.

(3) 


The car is sitting on a surface, therefore, there is a normal force. At the maximum speed of travel over the hill, $F_N = 0$.

(4) $F_c = \frac{mv^2}{r} = \frac{(1200)(11.1)^2}{25} = 5914 = \underline{5900\,N}$

(5) 


$F_g = mg = 1200(10) = \underline{12000\,N}$

$F_c = F_g - F_N$

$F_N = F_g - F_c = 12000 - 5900$

$= 6100\,N$

(6) $a = \frac{v^2}{r} = \frac{(11.1)^2}{25} = \underline{4.9\,m/s^2}$ towards the center of the circular path.

(7) If $F_N = 0$

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

$$\cancel{m}g = \frac{\cancel{m}v^2}{r}$$

$$v = \sqrt{gr} = \sqrt{10(25)} = 15.8 = \underline{16\ m/s}$$

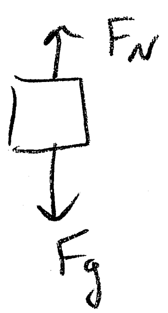
(8) The car would not stay on the road. It would "fly" up into the air when it hit the hill.

(9) . . . . . . .

(constant speed, so dsts are evenly spaced)

(10) The car is experiencing an acceleration towards the center of its circular path. When an object moves in a circle, it experiences an acceleration towards the center of the circular path.

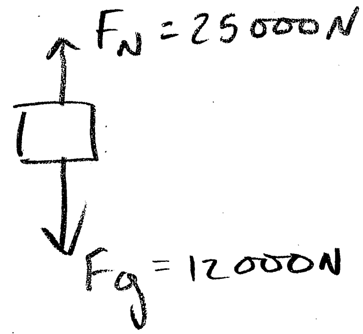
(11)




The car is sitting on a surface, therefore, there is a normal force. At maximum speed, the $F_N = F_g$

(12) $F_c = \frac{mv^2}{r} = \frac{(1200)(15.6)^2}{23} = 12697 = \underline{13000\ N}$

(13)




$F_g = mg = 1200(10) = 12000\ N$

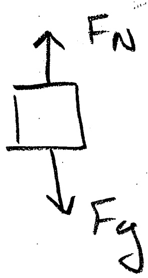
$F_c = F_N - F_g$

$F_N = F_c + F_g = 13000 + 12000$

$= 25000\ N$

(14) $a = \frac{v^2}{r} = \frac{(15.6)^2}{23} = 10.58 = \underline{10.6\ m/s^2}$

(15)




$m = \frac{F_g}{g}$

$F_c = F_N - F_g = \frac{mv^2}{r}$

$F_N = \frac{mv^2}{r} + F_g$

$F_N = \frac{F_g v^2}{g r} + F_g$

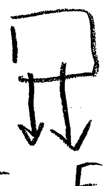
$= \frac{540(15.6)^2}{10(23)} + 540$

$= 6253 = \underline{6300\ N}$

# Unit VIII: Worksheet 2

① (a) $F_c = \frac{mv^2}{r} = \frac{55(65)^2}{380} = 611.5 = 610\,N$

(b)



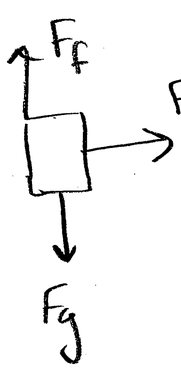

(plane is upside down, therefore the normal force from the seat is pointing down)

(c) $F_c = F_N + F_g = 610\,N$

$F_N = 610 - F_g = 610 - 55(10) = 60\,N$

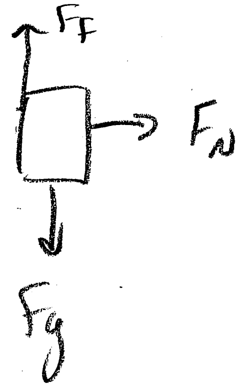
The woman feels lighter than normal as $F_N < F_g$.

②




The person is moving in a circle. Therefore a centripetal force exists. The centripetal force points towards the center of the circular path. In this case, the normal force is pointing in the direction of the centripetal force. This means that $F_N = F_c$.

2 continued.




The frictional force is holding the person in place. It must be equal to the gravitational force as these are the only forces acting in the vertical direction

$$F_f = F_g$$

$F_f = \mu F_N$ definition of frictional force.

$F_g = \mu F_N$ as stated above

$F_g = \mu \frac{mv^2}{r}$ since $F_N = F_c = \frac{mv^2}{r}$

$mg = \mu \frac{mv^2}{r}$ since $F_g = mg$

$v = \sqrt{\frac{gr}{\mu}}$ rearranging the equation

$$v = \sqrt{\frac{10(1.5)}{.5}} = \underline{2.7 \text{ m/s}}$$