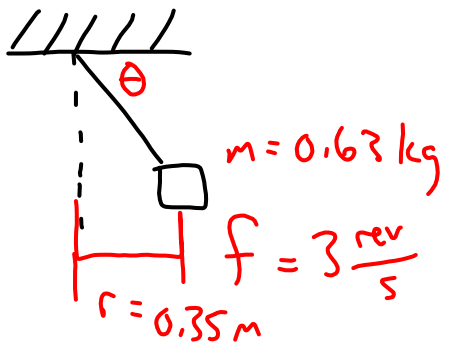
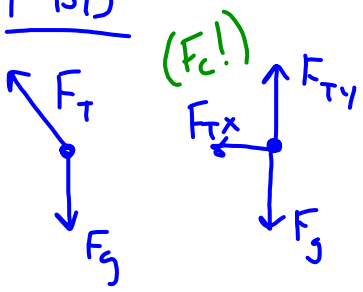
Circular Motion PS

2)



FBD



$$T = \frac{1}{f} = \frac{1}{3\ rev/s} = 0.33\ s$$

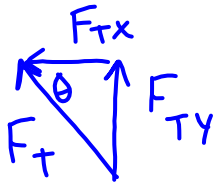
a) $F_c = ma_c$

$F_c = F_{TX}$ $\quad F_{TX} = \frac{mv^2}{r}$ $\quad a_c = \frac{v^2}{r}$

$$= \frac{m\left(\frac{2\pi r}{T}\right)^2}{r} \qquad v = \frac{2\pi r}{T}$$

$$= 78.3\ N$$

b)



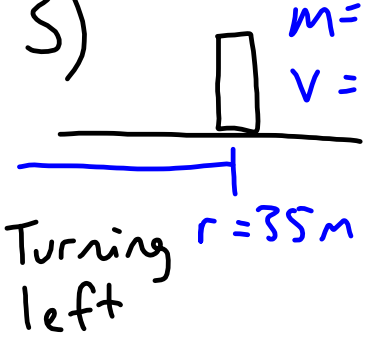
$F_{TY} = F_g = ma_g = 6.17\ N$

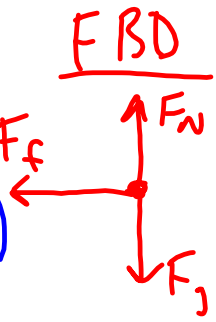
$$\tan\theta = \frac{F_{TY}}{F_{TX}}$$

$$\theta = \tan^{-1}\left(\frac{F_{TY}}{F_{TX}}\right)$$

$$= 4.42^\circ$$

3)





$$F_f = \mu F_N$$

$$a_c = \frac{v^2}{r}$$

$$= \frac{(19\ m/s)^2}{(35\ m)}$$

$$= 10.31\ m/s^2$$

$$F_c = ma_c$$

$$F_f = ma_c$$

$$= (1240\ kg)(10.31\ m/s^2)$$

$$= 12789\ N$$

$$\mu = \frac{F_f}{F_N}$$

$$= \frac{12789\ N}{12152\ N}$$

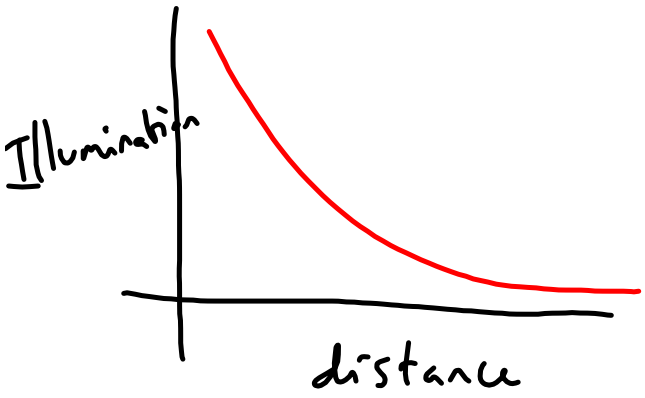
$$= 1.05$$

$$F_N = F_g = ma_g$$

$$= (1240\ kg)(9.8\ m/s^2)$$

$$= 12152\ N$$

Light Intensity from Source



	Distance	Illumination	Ratio of illuminations (new/original)
d	10	4400	
$2d$	20	1000	$\frac{1000}{4400} = \frac{1}{4.4} \approx \frac{1}{4}$
$3d$	30	450	$\frac{450}{4400} = \frac{1}{9.77} \approx \frac{1}{9}$
$4d$	40	250	$\frac{250}{4400} = \frac{1}{17.6} \approx \frac{1}{16}$

INVERSE SQUARE!

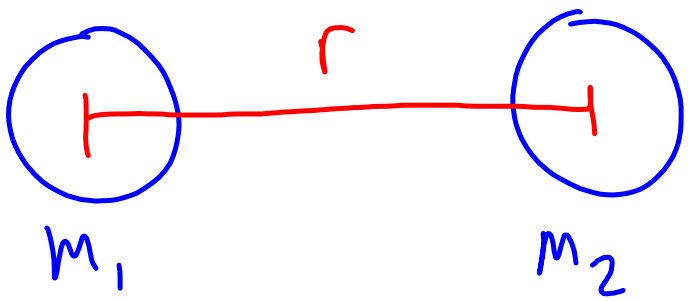
Newton's Law of Universal Gravitation

$$F_g = \frac{G m_1 m_2}{r^2}$$

$G \rightarrow$ constant!

$G = 6.67E-11$

$N \cdot m^2/kg^2$



Chart

$g = \frac{GM_1}{r^2}$

Radius in terms of original r	g in terms of original g	value of new g (if old $g = 5.8\ m/s^2$)
$\frac{1}{3}r$	$g_{new} = \frac{GM_1}{(\frac{1}{3}r)^2} = \frac{9GM_1}{r^2} = 9g$	$88.3\ m/s^2$
$2r$	$g_{new} = \frac{GM_1}{(2r)^2} = \frac{GM_1}{4r^2} = \frac{1}{4}g$	
$3r$	$g_{new} = \frac{GM_1}{(3r)^2} = \frac{GM_1}{9r^2} = \frac{1}{9}g$	
$4r$	$g_{new} = \frac{GM_1}{(4r)^2} = \frac{GM_1}{16r^2} = \frac{1}{16}g$	
$\frac{1}{2}r$	$g_{new} = \frac{GM_1}{(\frac{1}{2}r)^2} = \frac{GM_1}{(\frac{1}{4})r^2} = 4g$	
$6r$	$g_{new} = \frac{GM_1}{(6r)^2} = \frac{GM_1}{(\frac{1}{36})r^2} = \frac{1}{36}g$	
$\frac{1}{6}r$	$g_{new} = \frac{GM_1}{(\frac{1}{6}r)^2} = \frac{GM_1}{(\frac{1}{36})r^2} = 36g$	
$\frac{1}{100}r$	$g_{new} = \frac{GM_1}{(\frac{1}{100}r)^2} = \frac{GM_1}{(\frac{1}{10000})r^2} = 10000g$	
$\frac{1}{\sqrt{2}}r$	$g_{new} = \frac{GM_1}{(\frac{1}{\sqrt{2}}r)^2} = \frac{GM_1}{(\frac{1}{2})r^2} = 2g$	