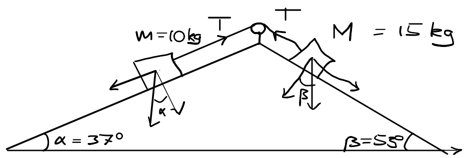
1-06-44



(m): $\quad -mg\sin\alpha + T = am$

(M): $\quad Mg\sin\beta - T = aM$

we can add the two equations to eliminate T:

$$-mg\sin\alpha + Mg\sin\beta = am + aM$$

$$\rightarrow \quad a = \frac{g\{M\sin\beta - m\sin\alpha\}}{m+M}$$

$a = 2{,}34\ m/s^2$

notice how the direction of the acceleration depends on m, M, and the angles

To find T we obviously can then subtract the equations

$\{(m) - (M)\}$ symbolically

$$-mg\sin\alpha - Mg\sin\beta + 2T = a\{m - M\}$$

$$\rightarrow \quad -g\{m\sin\alpha + M\sin\beta\} + 2T = \frac{g\{M\sin\beta - m\sin\alpha\}(m-M)}{m+M}$$

$$\rightarrow \quad T = \underbrace{\frac{g}{2}\{m\sin\alpha + M\sin\beta\}}_{\text{T for a = 0}} + \underbrace{\frac{g}{2}\{M\sin\beta - m\sin\alpha\}\frac{m-M}{m+M}}_{\text{This term vanishes if a = 0}}$$

or we could have used

$a \rightarrow (m)$: $\quad -mg\sin\alpha + T = \frac{mg}{m+M}\{M\sin\beta - m\sin\alpha\}$

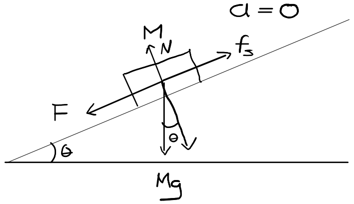
$$\rightarrow \quad T = mg\sin\alpha + \frac{mg}{m+M}\{M\sin\beta - m\sin\alpha\}$$

$= 82{,}4\ N$

1-06-56

$v = 0$

$a = 0$



$f_s = \mu_s N = \mu_s Mg\cos\theta$

$F = Mg\sin\theta$

$a = 0 \quad \rightarrow \quad \vec{f_s} + \vec{F} = 0$

i.e. $\quad Mg\sin\theta = \mu_s Mg\cos\theta$

$\rightarrow \sin\theta = \mu_s\cos\theta \quad \rightarrow \quad \tan\theta = \mu_s$

$\rightarrow \quad \theta = \arctan\mu_s$

1-06-74

The Bohr model

$R = 5{,}28 \cdot 10^{-11}\ m$ for e

$v = 2{,}18 \cdot 10^{6}\ m/s$

$m_e = 9{,}11 \cdot 10^{-31}\ kg$

$$F_c = m_e\frac{v^2}{R} = \frac{9{,}11 \cdot 10^{-31}(2{,}18 \cdot 10^{6})^2}{5{,}28 \cdot 10^{-11}} = 8{,}2 \cdot 10^{-8}\ N$$

Corresponding acceleration

$a_c = \frac{v^2}{R} = 9 \cdot 10^{22}\ m/s^2$!, but ....

$L = 0$ in QM

1-06-88

Air resistance on a skydiver $\quad f = -bv^2, \quad v_T = 60\ m/s$

$M = 50\ \underline{kg}$, find b

Equation of motion

$$\underbrace{m\frac{dv}{dt}}_{=0} = \underline{Mg} - bv^2 \longrightarrow \underline{Mg} = bv_T^2$$

$$\rightarrow b = \frac{Mg}{v_T^2} = \frac{50\,\underline{kg} \cdot 9{,}81\ m/s^2}{(60)^2\ \frac{m^2}{s^2}}$$

$$= 0{,}136\ \underline{kg}/m$$