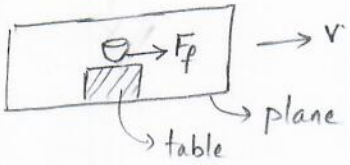
Solutions PHYS 205A-001 (Midterm Exam 02) Spring 2022

Problem 1

Gravitational force on Earth by mass m is the reaction pair of mg. Thus, it is 98 N.

Problem 2

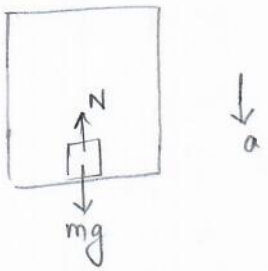


tendency of cup is to move backward when the plane accelerates in the forward direction. Thus, friction acts in the forward direction.

Problem 3

Turning requires accelerat to the right. In the absence of friction and banking this is not possible.

Problem 4



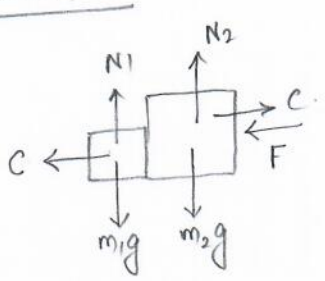
$$-ma = -mg + N$$

$$N = mg - ma$$

$$= 75\,(9.8 - 2.0)$$

$$= 590\ \text{N}$$

Problem 5



C – contact force by m_1 on m_2

m_1 : $-m_1 a = -C$

m_2 : $-m_2 a = -F + C$

$(m_1 + m_2)\, a = F \Rightarrow a = \frac{F}{m_1 + m_2} = \frac{33}{10.0 + 20.0}$

$= 1.1 \ \frac{m}{s^2}$.

$C = m_1 a = \frac{m_1}{m_1 + m_2} F$

$= \left(\frac{10.0}{10.0 + 20.0}\right) 33 = 11 \ N$.

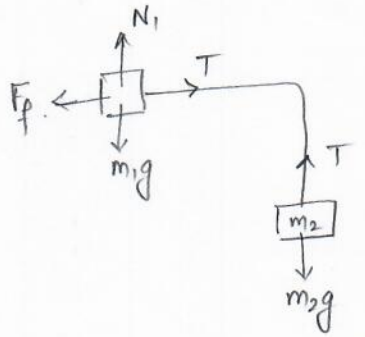
Problem 6

m_2 : $m_2 a = m_2 g - T$

m_1 ; x : $m_1 a = T - F_f$

y : $N_1 = m_1 g$

minimal : $a = 0$ and $F_f = \mu_s N_1$



$m_2 g = F_f \leq \mu_s N_1 = \mu_s m_1 g$

$m_2 \leq \mu_s m_1 = (0.50)(1.0) = \underline{0.50 kg}$.

Problem 7

$V = V_T \left(1 - e^{-\frac{t}{\tau}}\right)$

$0.95\, V_T = V_T \left(1 - e^{-\frac{t}{\tau}}\right)$

$0.95 = 1 - e^{-\frac{t}{\tau}}$

$e^{-\frac{t}{\tau}} = 0.050$

$-\frac{t}{\tau} = \ln(0.050)$

$t = -\tau \ln(0.050)$

$\tau = \frac{V_T}{g} = \frac{9.8 \ mm/s}{9.8 \ m/s^2}$

$= 1.0 \times 10^{-3} s$

$t = -(1.0 \times 10^{-3}) \ln(0.050)$

$= 3.0 \times 10^{-3} s$

$= 3.0 \ ms$.