

Solutions

PHYS- 203A-002

(Midterm Exam 02)

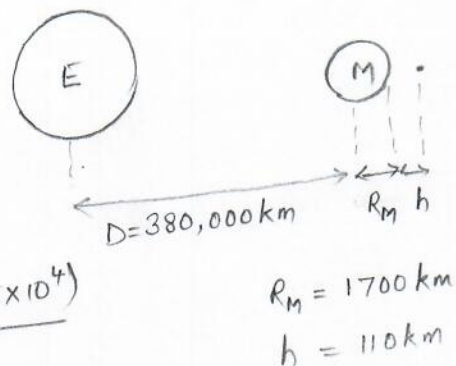
Fall 2021

①

Problem 1

$$\begin{aligned} r &= D + R_M + h \\ &= (380\,000 + 1700 + 110) \text{ km} \\ &= 381\,810 \text{ km} \\ &= 380\,000 \text{ km} \quad (2 \text{ sig. digits}) \end{aligned}$$

$$\begin{aligned} F &= \frac{G M_E M_S}{r^2} = \frac{(6.7 \times 10^{-11}) (6.0 \times 10^{24}) (1.5 \times 10^4)}{(3.8 \times 10^8)^2} \\ &= 42 \text{ N} \end{aligned}$$



Problem 2



Problem 3

In the forward direction.

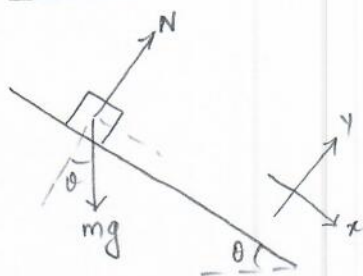
Problem 4

magnitude:

$$a = \frac{v^2}{R} = \frac{15^2}{150} = 1.5 \frac{\text{m}}{\text{s}^2}$$

direction:

towards the center of circle in figure.

Problem 5

$$m\vec{a} = m\vec{g} + \vec{N}$$

$$\underline{x} \quad ma = mg \sin \theta + 0$$

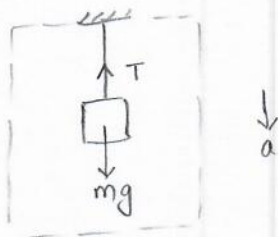
$$a = g \sin \theta$$

$$= 9.8 \sin 30$$

$$= 4.9 \frac{\text{m}}{\text{s}^2}$$

$$\underline{y} \quad 0 = -mg \cos \theta + N$$

$$N = mg \cos \theta$$

Problem 6

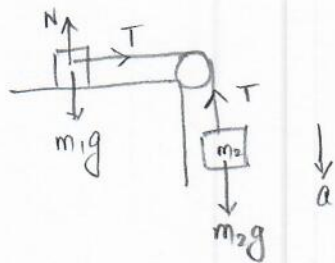
$$m\vec{a} = m\vec{g} + \vec{T}$$

$$-ma = -mg + T$$

$$T = mg - ma$$

$$= 5.0 (9.8 - 2.0)$$

$$= 39 \text{ Newtons}$$

Problem 7 m_2 :

$$m_2 g - T = m_2 a$$

 m_1 :

$$T = m_1 a$$

$$m_2 g = (m_1 + m_2) a$$

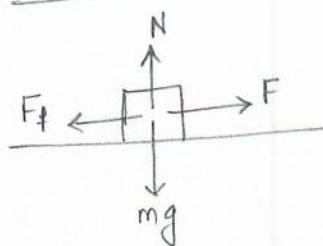
$$a = \frac{m_2}{(m_1 + m_2)} g$$

$$= \frac{2.0}{(1.0 + 2.0)} 9.8 = 6.5 \frac{\text{m}}{\text{s}^2}$$

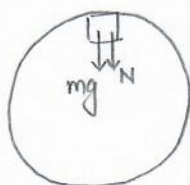
$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$= 0 + \frac{1}{2} (6.5) (1)^2$$

$$= 3.3 \text{ m}$$

Problem 8

$$\begin{aligned}
 F &= F_f \\
 &= \mu_s N \\
 &= \mu_s mg = (0.50)(196) = 98 \text{ N}
 \end{aligned}$$

Problem 9

$$m\vec{a} = m\vec{g} + \vec{N}$$

$$m \frac{v^2}{R} = mg + 0$$

$$v = \sqrt{gR} = \sqrt{(9.8)(12)} = 11 \frac{\text{m}}{\text{s}}$$