

Solution

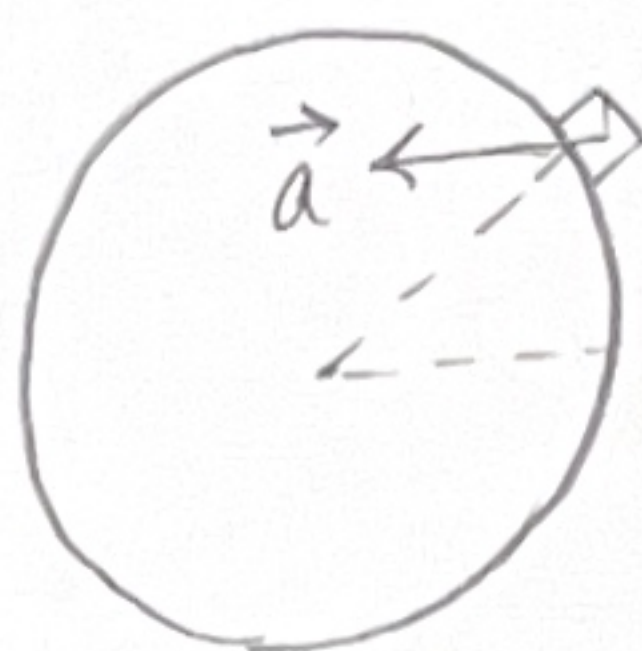
PHYS-205A-001

(Midterm Exam 02)

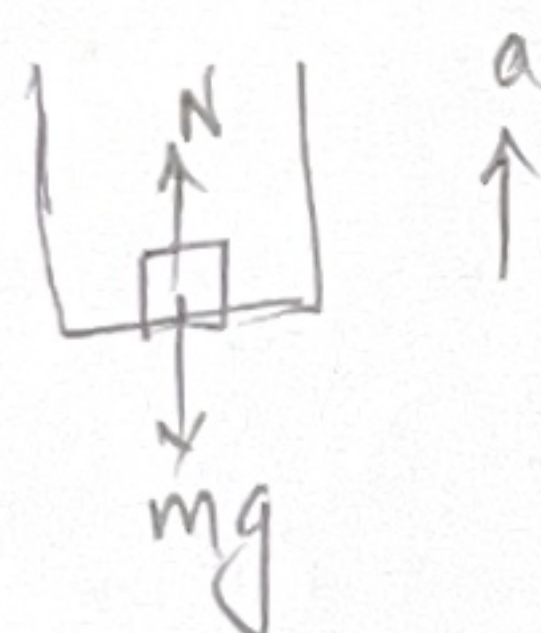
Spring 2025

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Problem 1



Problem 2



$$N = mg + ma$$

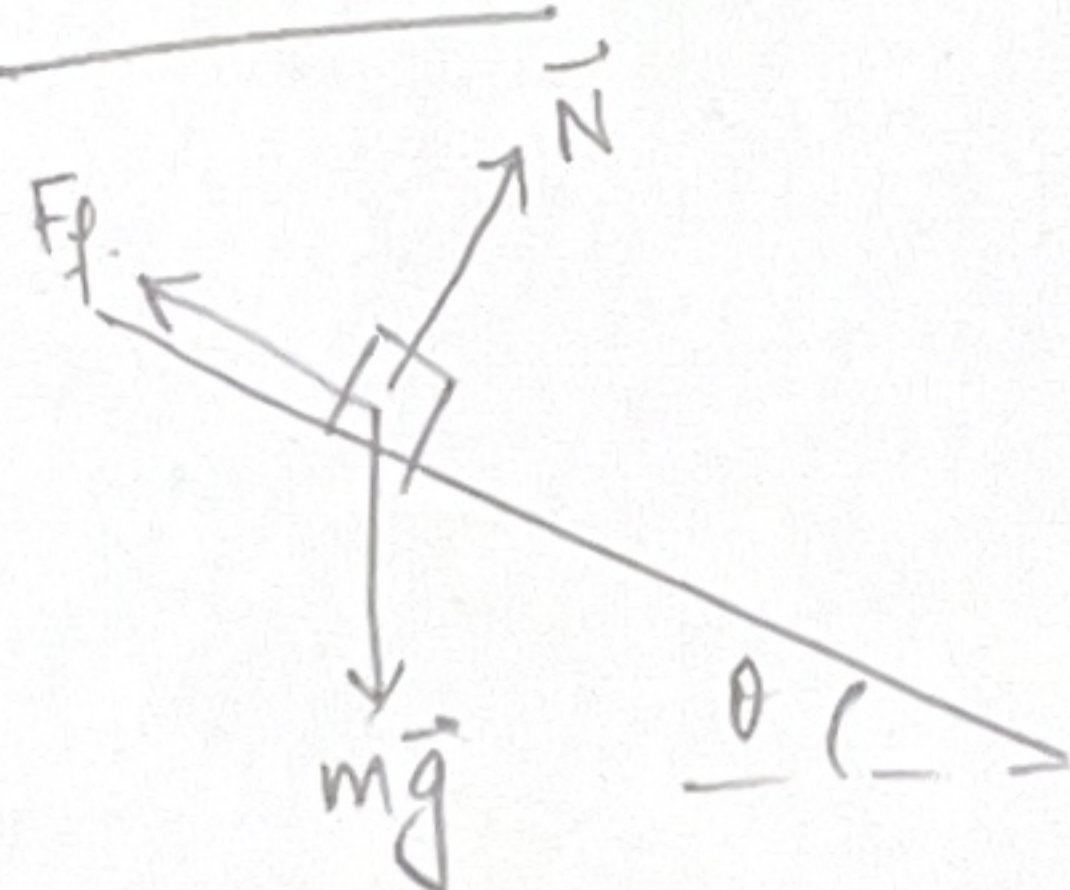
heavier

speeding while moving upward - $\uparrow a$

slowing while moving upward - $\downarrow a$

lighter.

Problem 3



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

$$0 = -mg \sin \theta + F_f$$

$$\begin{aligned} F_f &= mg \sin \theta \\ &= (10)(9.8) \sin 30 \\ &= 49 \text{ N} \end{aligned}$$

$$0 = -mg \cos \theta + N + 0$$

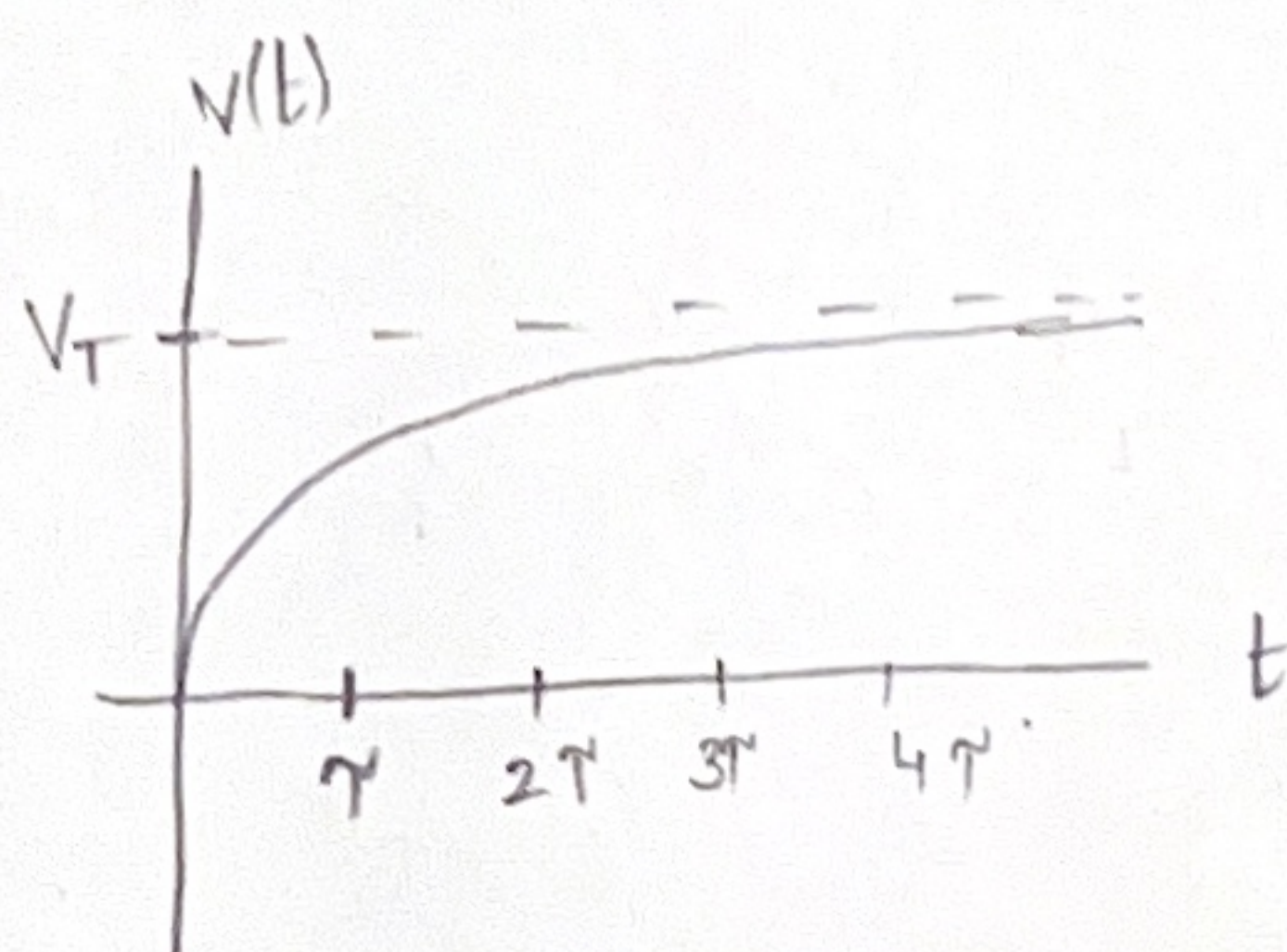
$$\begin{aligned} N &= mg \cos \theta \\ &= (10)(9.8) \cos 30 \\ &= 85 \text{ N} \end{aligned}$$

Note:

$$\begin{aligned} \mu_s N &= (0.80) 85 \\ &= 68 \text{ N} \end{aligned}$$

$$\begin{aligned} F_f &= mg \sin \theta \leq \mu_s N \\ &= 49 \text{ N} \leq 68 \text{ N} \end{aligned}$$

Problem 4



Problem 5

$$m\vec{a} = m\vec{g} + \vec{T}_1 + \vec{T}_2$$

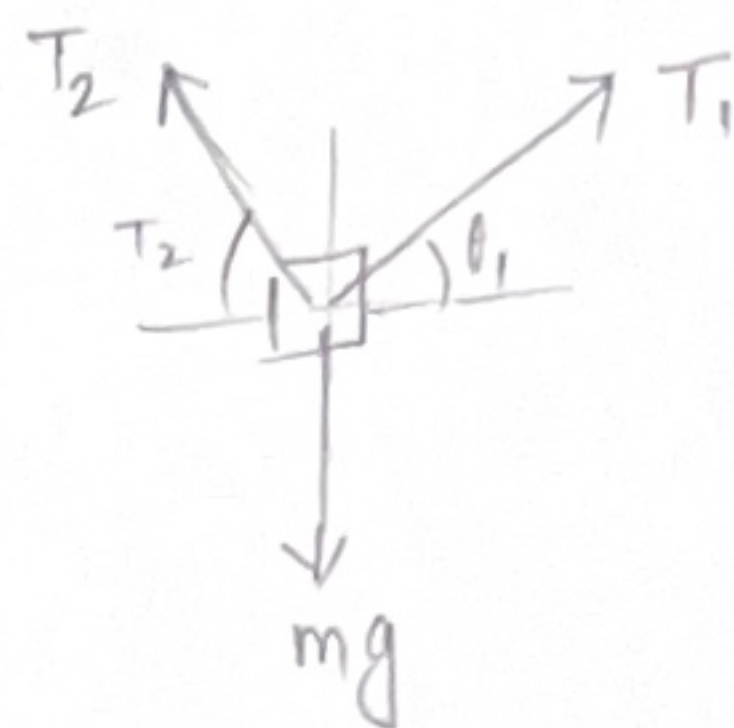
$$x: 0 = 0 + T_1 \cos \theta_1 - T_2 \cos \theta_2 \Rightarrow T_1 = 0.82 T_2$$

$$y: 0 = -mg + T_1 \sin \theta_1 + T_2 \sin \theta_2$$

$$(20)(9.8) = (0.82) T_2 \sin 30^\circ + T_2 \sin 45^\circ$$

$$\Rightarrow T_2 = 180 \text{ N}$$

$$T_1 = (0.82)(180) = 140 \text{ N}$$

Problem 6

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

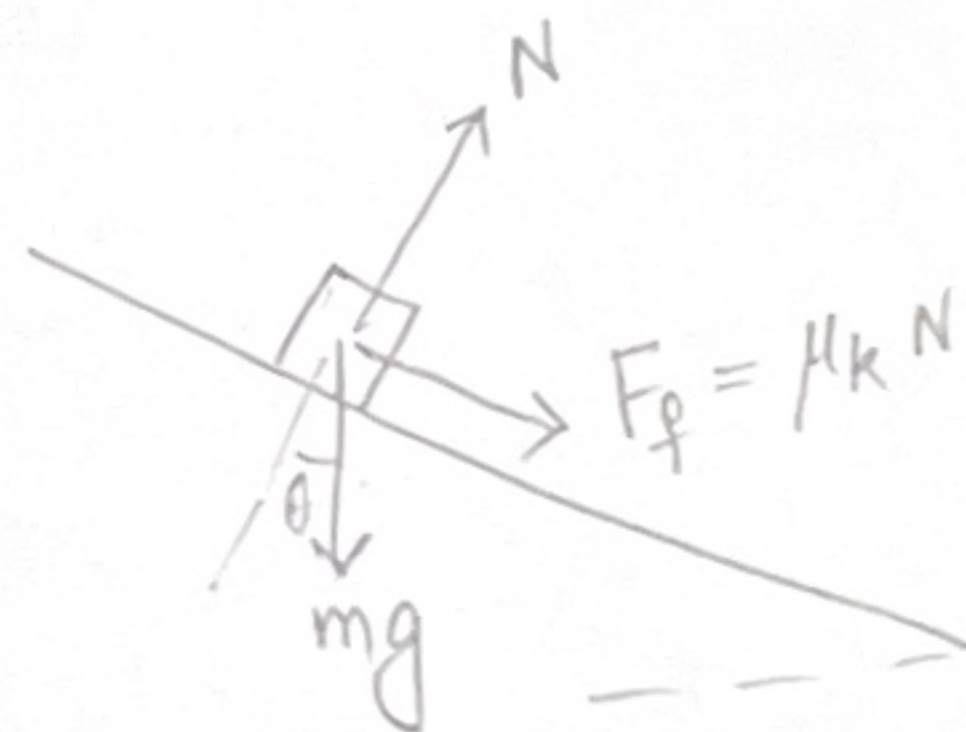
$$ma = mg \sin \theta + \mu_k N$$

$$a = g \sin \theta + \mu_k g \cos \theta$$

$$= 9.8 (\sin 30^\circ + 0.60 \cos 30^\circ)$$

$$= 10. \frac{\text{m}}{\text{s}^2}$$

$$N = mg \cos \theta$$



$$\Delta x = \frac{V_f^2 - V_i^2}{2a}$$

$$= \frac{0 - (15)^2}{2(10.)} = -11 \text{ m.}$$

Problem 7

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

$$-m \frac{v^2}{R} = -mg - N$$

$$N = m \frac{v^2}{R} - mg$$

$$= 12 \left(\frac{14^2}{15} - 9.8 \right)$$

$$= 12 (3.3) = 40. \text{ Newtons}$$

