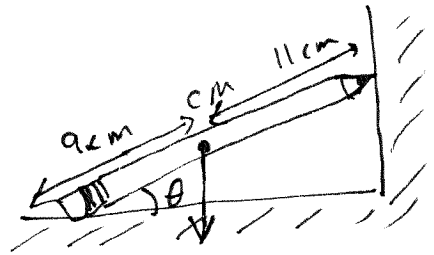


Chapter 12Problem 70

$$\mu_s = 0.80$$

Find the minimum angle where the eraser doesn't slip.



From the free-body diagram

$$\sum F = ma = 0 \quad (\text{No friction at pencil tip})$$

$$N\hat{j} + F_f\hat{i} - W\hat{j} - F_w\hat{i} = 0$$

X-dir) $F_f - F_w = 0 \quad \therefore F_f = F_w$

y-dir) $N - W = 0 \quad \therefore N = W = mg$

$$\sum \tau = I\alpha = 0 \quad (\text{Chose pivot at eraser})$$

θ_1 is the complement of θ

$$-9 \cdot mg \cos\theta + 20 F_w \sin\theta = 0$$

$$20 F_w \sin\theta = 9 mg \cos\theta$$

Now $F_w = F_f = \mu N = \mu mg$

$$\therefore 20 [\mu mg] \sin\theta = 9 mg \cos\theta$$

$$\frac{\sin\theta}{\cos\theta} = \frac{9 mg}{20 \mu mg} = \frac{9}{20 \mu}$$

$$\tan\theta = \frac{9}{20 [0.80]} = \frac{9}{16} = 0.56$$

$$\theta = \tan^{-1}(0.56) = \boxed{29.4^\circ}$$

