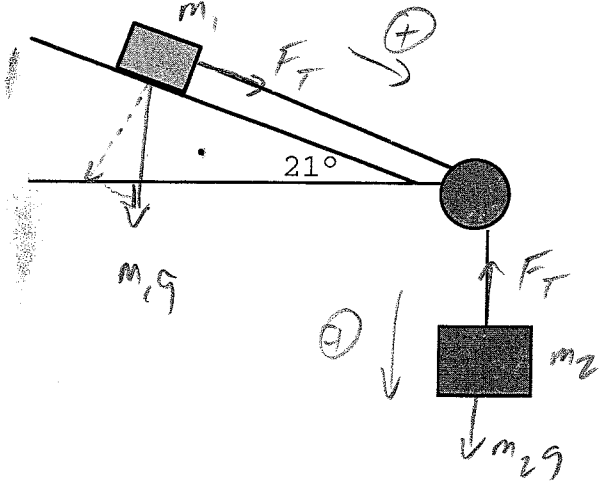


Physics 10154 - Exam #4D

Each problem is worth 50 points. Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. Two crates are connected by a thin rope parallel to the incline as shown below. The hanging crate (6.5 kg) is 35 cm above the floor, and the system starts at rest. The other crate (8.5 kg) is on a frictionless incline. How much time elapses before the hanging crate hits the floor?



$$\Sigma F_1 = F_T + m_1 g \sin 21^\circ = m_1 a$$

$$\Sigma F_2 = m_2 g - F_T = m_2 a$$

$$F_T = m_2 g - m_2 a$$

$$\text{so } m_2 g - m_2 a + m_1 g \sin 21^\circ = m_1 a$$

$$m_2 g + m_1 g \sin 21^\circ = (m_1 + m_2) a$$

$$a = \frac{m_2 g + m_1 g \sin 21^\circ}{m_1 + m_2} = \frac{63.7 + 29.9}{15}$$

$$= 6.24 \text{ m/s}^2$$

$$\Delta s = v_0 t + \frac{1}{2} a t^2$$

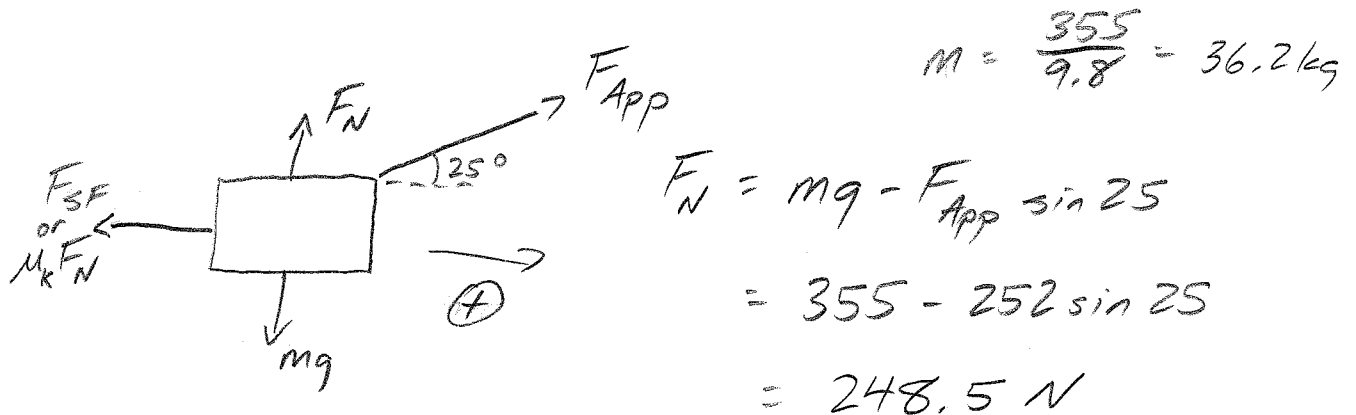
$$0.35 = 0 + \frac{1}{2} (6.24) t^2$$

$$t^2 = \frac{0.35}{3.12}$$

$$\Rightarrow \boxed{t = 0.33 \text{ s}}$$

2. A 355 Newton wooden box is at rest on a rough surface. An applied force of 252 Newtons, directed 25° above the horizontal, pulls on the box. The coefficient of static friction is 0.75, and the coefficient of kinetic friction is 0.45.

Does the crate move? If so, what is its acceleration? If not, what is the force of static friction acting on the crate?



$$\Sigma F_{\parallel} = F_{\text{App}} \cos 25 - F_{\text{SF}} = 0$$

$$F_{\text{SF}} = 252 \cos 25 = 228 \text{ N}$$

$$F_{\text{SF, MAX}} = (0.75)(248.5) = 186 \text{ N}$$

Since $F_{\text{SF}} > F_{\text{SF, MAX}}$, box moves

$$228 \quad 186$$

$$\Sigma F_{\parallel} = F_{\text{App}} \cos 25 - M_K F_N = ma$$

$$252 \cos 25 - (0.45)(248.5) = 36.2 a$$

$$228.3 - 111.8 = 36.2 a$$

$$a = 3.2 \text{ m/s}^2$$