

Module 05 - Lesson 3

Acceleration Constraints

Question 1: Two boxes are connected by a light string that passes over a light, frictionless pulley. One box rests on a frictionless ramp, as shown in Fig. 1. The system is released from rest, and the acceleration of the 50-kg box has a magnitude of 0.25 m/s^2 and it is directed up the inclined plane. What is the acceleration of the 30-kg box? Explain your answer.

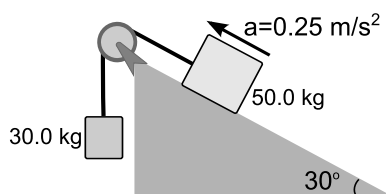


FIG. 1: Boxes on inclined plane

Question 2: A 20.0-kg crate rests on the back of a 2000-kg pickup truck. If the pickup truck accelerates forward at an acceleration of 3.0 m/s^2 , what is the acceleration of the crate after it slams against the back of the pickup truck?

Problem: A sled of mass $m_1 = 20 \text{ kg}$ slides on a horizontal frictionless patch of snow, while a package of mass $m_2 = 5 \text{ kg}$ rests on the sled. A constant force of magnitude $F = 10 \text{ N}$ accelerates the sled forward. Assume that the package does not slip on the sled. (a) Identify the horizontal force that causes the package to accelerate. (b) Find the acceleration of the sled and the acceleration of the package.