Physics 101
Lecture 5
Extra Problems

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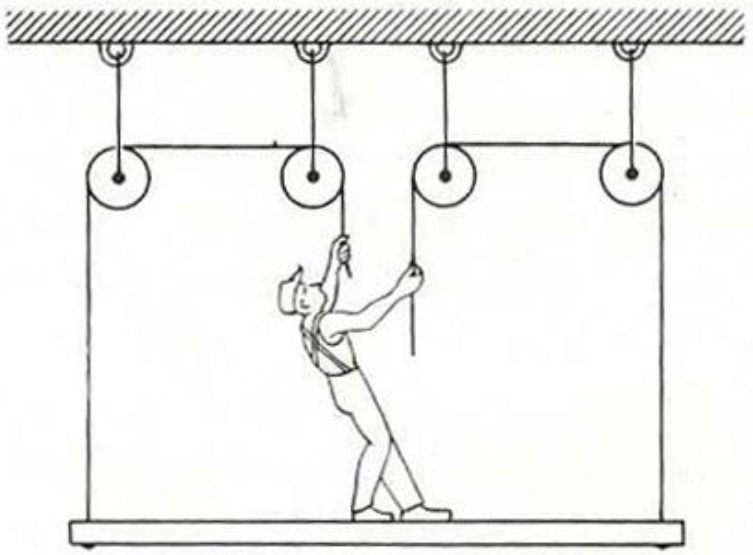
Problem 1: A painter of mass m1 stands on a platform of mass m2 and pulls himself up by two ropes that run over massless pulleys, as shown. He pulls on each rope with a force of magnitude F and accelerates upward with a uniform acceleration a . Find the acceleration a .



Problem 2:

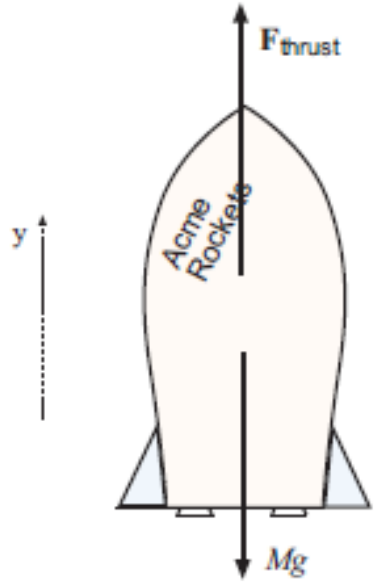
If a man weighs 875N on Earth, what would he weigh on Jupiter, where the free–fall acceleration is 25.9 m/s^2 ?

Problem 3:

A 210 kg motorcycle accelerates from 0 to 55 mi/hr in 6.0 s. (a) What is the magnitude of the motorcycle's constant acceleration? (b) What is the magnitude

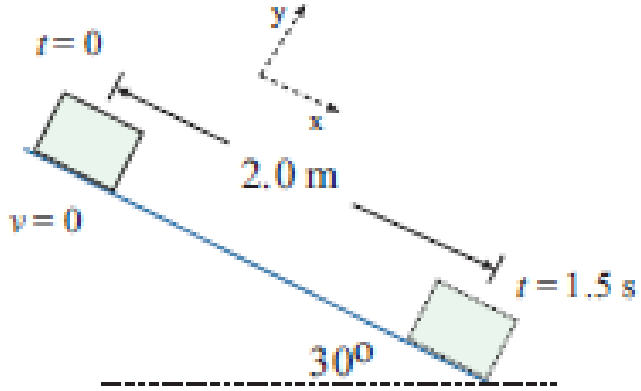
of the net force causing the acceleration? (1mi =1609m)

Problem 4: A rocket and its payload have a total mass of 5.0 × 10^4 kg. How large is the force produced by the engine (the thrust) when (a) the rocket is "hovering" over the launchpad just after ignition, and (b) when the rocket is accelerating upward at 20 m/s^2 ?

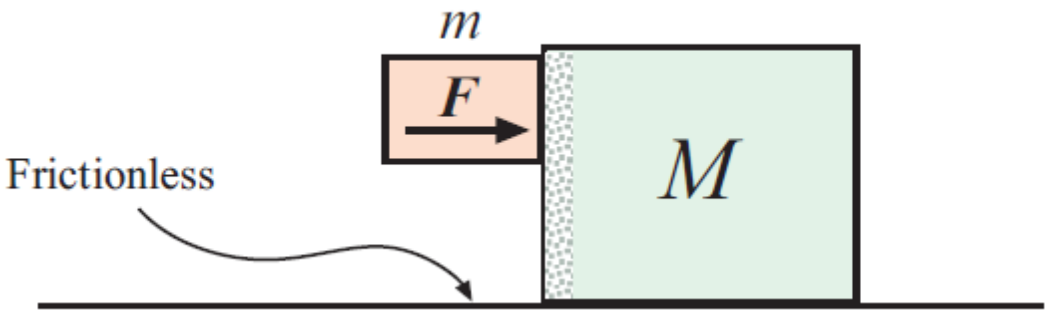


Problem 5:

5. A $3.0-\text{kg}$ block starts from rest at the top of a $30.0°$ incline and slides $2.0\,\text{m}$ down the incline in $1.5\,\text{s}$. Find (a) the magnitude of the acceleration of the block, (b) the coefficient of kinetic friction between the block and the plane, (c) the frictional force acting on the block and (d) the speed of the block after it has slid $2.0\,\text{m}$.

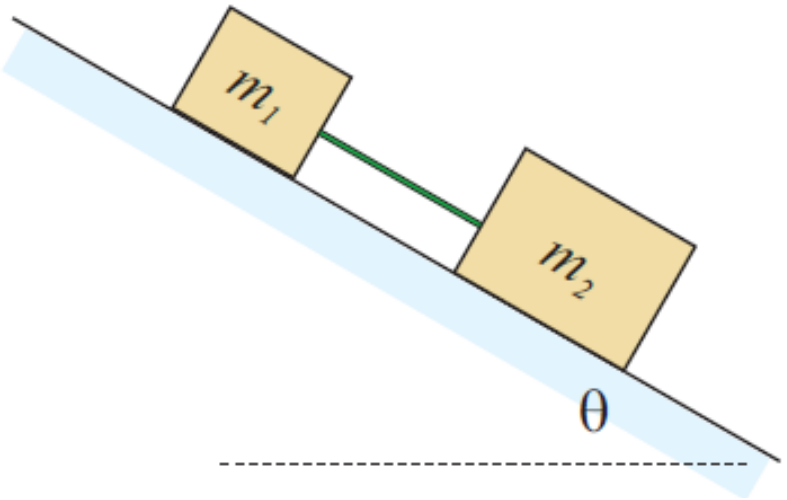


Problem 6:



The two blocks (with m = 16 kg and M = 88 kg) shown in Fig. are not attached. The coefficient of static friction between the blocks is μs = 0.38, but the surface beneath M is frictionless. What is the minimum magnitude of the horizontal force F required to hold m against M?

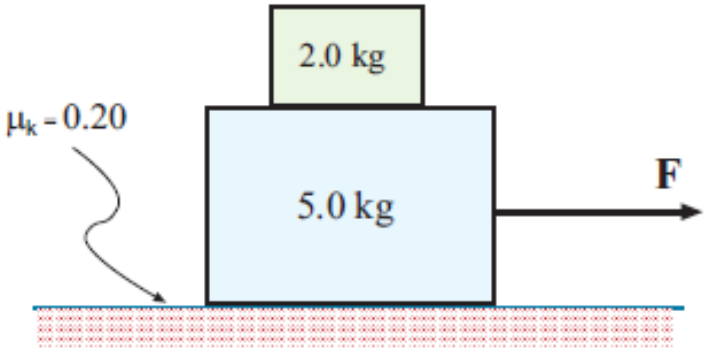
Problem 7:



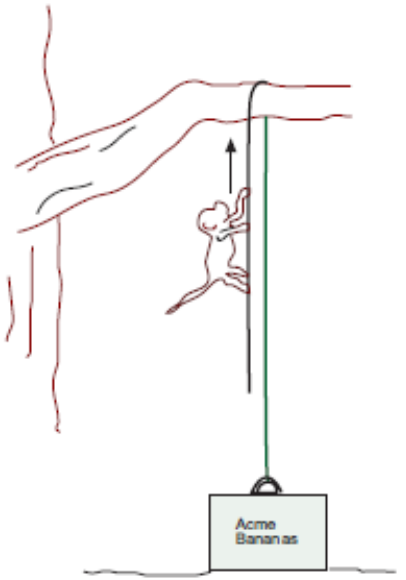
4. In Fig. 5.6 a box of mass $m_1 = 1.65\,\text{kg}$ and a box of mass $m_2 = 3.30\,\text{kg}$ slide down an inclined plane while attached by a massless rod parallel to the plane. The angle of incline is $\theta = 30°$. The coefficient of kinetic friction between m_1 and the incline is $\mu_1 = 0.226$; that between m_2 and the incline is $\mu_2 = 0.113$. Compute (a) the tension in the rod and (b) the common acceleration of the two boxes. c) How would the answers to (a) and (b) change if m_2 trailed m_1?

Problem 8:

8. A $2.0\,\text{kg}$ block is placed on top of a $5.0\,\text{kg}$ as shown in Fig. 5.12. The coefficient of kinetic friction between the $5.0\,\text{kg}$ block and the surface is 0.20. A horizontal force F is applied to the $5.0\,\text{kg}$ block. (a) Draw a free–body diagram for each block. What force accelerates the $2.0\,\text{kg}$ block? (b) Calculate the magnitude of the force necessary to pull both blocks to the right with an acceleration of $3.0\,\frac{\text{m}}{\text{s}^2}$. (c) find the minimum coefficient of static friction between the blocks such that the $2.0\,\text{kg}$ block does not slip under an acceleration of $3.0\,\frac{\text{m}}{\text{s}^2}$.



Problem 9: A 10 kg monkey climbs up a massless rope that runs over a frictionless tree limb (!) and back down to a 15 kg package on the ground, as shown in Fig.



(a) What is the magnitude of the least acceleration the monkey must have if it is to lift the package off the ground? If, after the package has been lifted the monkey stops its climb and holds onto the rope, what are (b) the monkey's acceleration and (c) the tension in the rope?