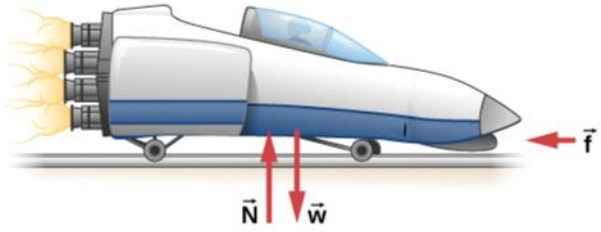
HW_4_Newtons_Laws_of Motion_Ch_5

Problems: 19, 29, 31, 37, 40, 51, 55, 63, 65, 67, 71, 81, Total = 12

19. Two ropes are attached to a tree, and forces of $\vec{\mathbf{F}}_1 = 2.0\,\hat{\mathbf{i}} + 4.0\,\hat{\mathbf{j}}$ N and $\vec{\mathbf{F}}_2 = 3.0\,\hat{\mathbf{i}} + 6.0\,\hat{\mathbf{j}}$ N are applied. The forces are coplanar (in the same plane). (a) What is the resultant (net force) of these two force vectors? (b) Find the magnitude and direction of this net force.

acceleration

29. The rocket sled shown below decelerates at a rate of $196\ \text{m/s}^2$. What force is necessary to produce this deceleration? Assume that the rockets are off. The mass of the system is 2.10×10^3 kg.

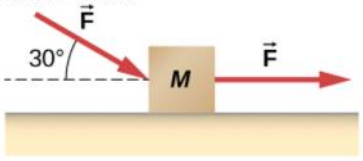


acceleration

31. What is the deceleration of the rocket sled if it comes to rest in 1.10 s from a speed of 1000.0 km/h? (Such deceleration caused one test subject to black out and have temporary blindness.)

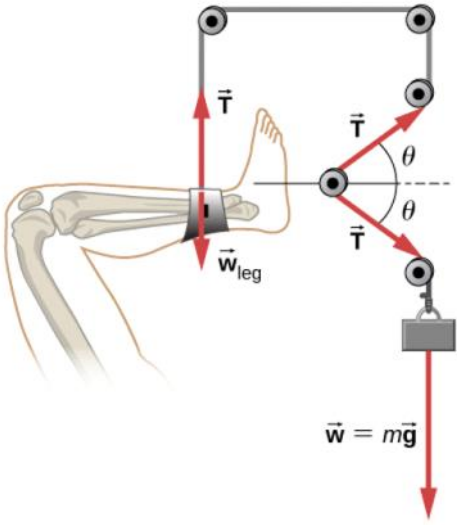
37. A particle of mass 2.0 kg is acted on by a single force $\vec{\mathbf{F}}_1 = 18\,\hat{\mathbf{i}}$ N. (a) What is the particle's acceleration? (b) If the particle starts at rest, how far does it travel in the first 5.0 s?

40. In the following figure, the horizontal surface on which this block slides is frictionless. If the two forces acting on it each have magnitude $F = 30.0\,\text{N}$ and $M = 10.0\,\text{kg}$, what is the magnitude of the resulting acceleration of the block?



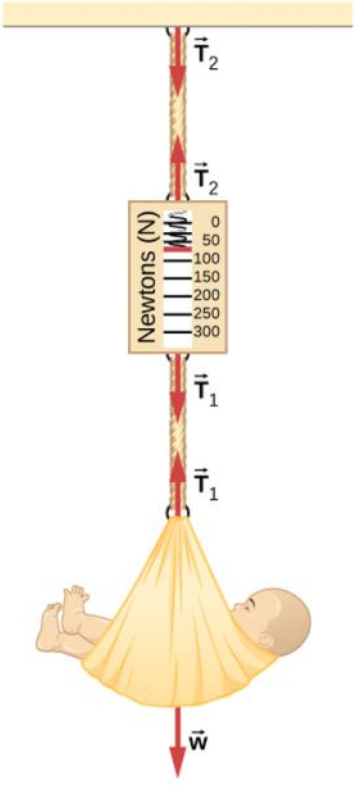
51. (a) What net external force is exerted on a 1100.0-kg artillery shell fired from a battleship if the shell is accelerated at $2.40 \times 10^4\ \text{m/s}^2$? (b) What is the magnitude of the force exerted on the ship by the artillery shell, and why?

55. A leg is suspended in a traction system, as shown below. (a) Which part of the figure is used to calculate the force exerted on the foot? (b) What is the tension in the rope? Here $\vec{\mathbf{T}}$ is the tension, $\vec{\mathbf{w}}_{\text{leg}}$ is the weight of the leg, and $\vec{\mathbf{w}}$ is the weight of the load that provides the tension.

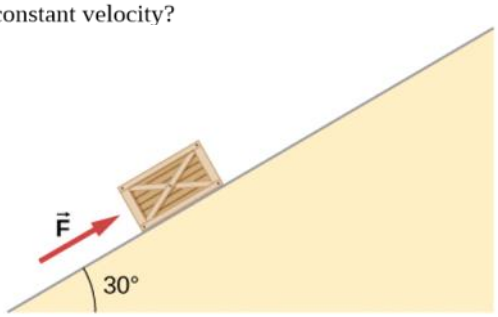


63. A bird has a mass of 26 g and perches in the middle of a stretched telephone line. (a) Show that the tension in the line can be calculated using the equation $T = \dfrac{mg}{2\sin\theta}$. Determine the tension when (b) $\theta = 5°$ and (c) $\theta = 0.5°$. Assume that each half of the line is straight.

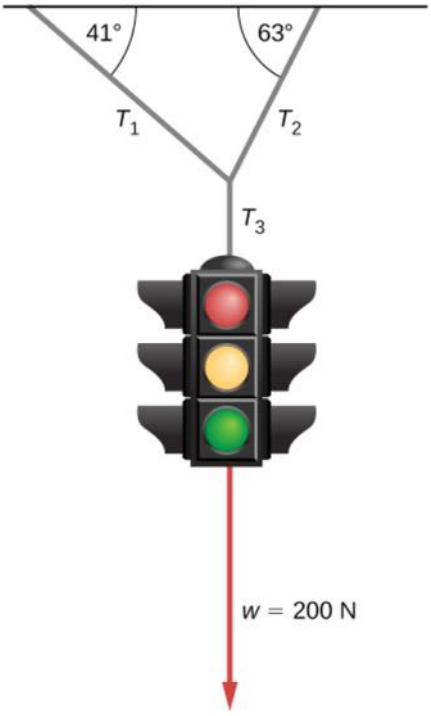
65. Consider the baby being weighed in the following figure. (a) What is the mass of the infant and basket if a scale reading of 55 N is observed? (b) What is tension T_1 in the cord attaching the baby to the scale? (c) What is tension T_2 in the cord attaching the scale to the ceiling, if the scale has a mass of 0.500 kg? (d) Sketch the situation, indicating the system of interest used to solve each part. The masses of the cords are negligible.



67. A 2.0-kg block is on a perfectly smooth ramp that makes an angle of $30°$ with the horizontal. (a) What is the block's acceleration down the ramp and the force of the ramp on the block? (b) What force applied upward along and parallel to the ramp would allow the block to move with constant velocity?



71. The traffic light hangs from the cables as shown. Draw a free-body diagram on a coordinate plane for this situation.



81. Force $\vec{F}_B$ has twice the magnitude of force $\vec{F}_A$. Find the direction in which the particle accelerates in this figure.