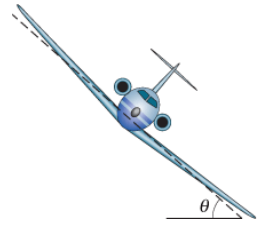# Chapter 6 – Problem Day

53. An airplane is flying in a horizontal circle at a speed of 480 km/h. If its wings are tilted at angle 40° to the horizontal, what is the radius of the circle in which the plane is flying? The required force is provided entirely by an "aerodynamic lift" that is perpendicular to the wing surface.

64. In the figure, block 1 of mass $m_1 = 2.0$ kg and block 2 of mass $m_2 = 3.0$ kg are connected by a string of negligible mass and are initially held in place. Block 2 is on a frictionless surface tilted at 30°. The coefficient of kinetic friction between block 1 and the horizontal surface is 0.25. The pulley has negligible mass and friction. Once they are released, the blocks move. What then is the tension in the string?
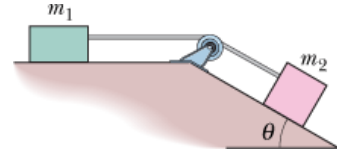
71. A locomotive accelerates a 25-car train along a level track. Every car has a mass of 50,000 kg and is subject to a frictional force $f = 250v$, where the speed $v$ is in meters per second and the force $f$ is in Newtons. At the instant when the speed of the train is 30 km/h, the magnitude of its acceleration is 0.20 m/s$^2$. (a) What is the tension in the coupling between the first car and the locomotive? (b) If this tension is equal to the maximum force the locomotive can exert on the train, what is the steepest grade up which the locomotive can pull the train at 30 km/h?

88. A certain string can withstand a maximum tension of 40 N without breaking. A child ties a 0.37 kg stone to one end and, holding the other end, whirls the stone in a vertical circle of radius 0.91 m, slowly increasing the speed until the string breaks. (a) Where is the stone on its path when the string breaks? (b) What is the speed of the stone as the string breaks?

98. A circular curve of highway is designed for traffic moving at 60 km/h. Assume cars without negative lift. (a) If the radius of the curve is 150 m, what is the correct angle of banking of the road? (b) If the curve were not banked, what would be the minimum coefficient of friction between tires and road that would keep traffic from skidding out of the turn when traveling at 60 km/h?

# Chapter 6 Answers

3)      0.525

14a)    it doesn't move
14b)    9.0 m/s$^2$

19a)    19.3°
19b)    3330 N

23)     103 N

31a)    66 N
31b)    2.3 m/s$^2$

35)     9.9 s

37)     2.3

51)     12°

58)     0.078

59a)    8.7 N
59b)    37.85 N
59c)    6.45 m/s
59d)    towards the pole