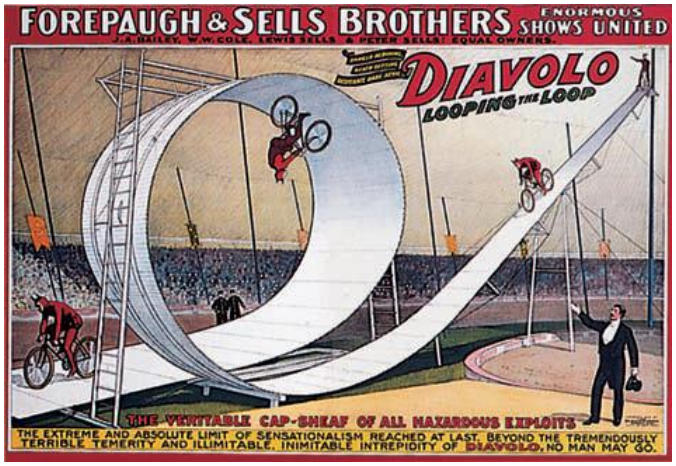
1. A rock is shot vertically upward from the edge of the top of a tall building. The rock reaches its maximum height above the top of the building t_0=1.60 s after being shot. Then, after barely missing the edge of the building as it falls downward, the rock strikes the ground t_f=6.00 s after it is launched. In SI units: (a) with what upward velocity ($\mathbf{v_{in}}$) is the rock shot, (b) how tall (d) is the building?

Answer:a) 15.7 m/s b) 82.3 m

2. "Top gun" pilots have long worried about taking a turn too tightly. As a pilot's body undergoes centripetal acceleration, with the head toward the center of curvature, the blood pressure in the brain decreases, leading to loss of brain function. There are several warning signs. When the centripetal acceleration is 2*g* or 3*g*, the pilot feels heavy. At about 4*g*, the pilot's vision switches to black and white and narrows to "tunnel vision." If that acceleration is sustained or increased, vision ceases and, soon after, the pilot is unconscious, a condition known as *g*-LOC for "*g*-induced loss of consciousness."
What is the magnitude of the acceleration, in *g* units, of a pilot whose aircraft enters a horizontal circular turn with a velocity of (400**i**, 500**j**) m/s and 24.0 s later leaves the turn with a velocity of (-400**i**, -500**j**) m/s?

Answer: 8.5g

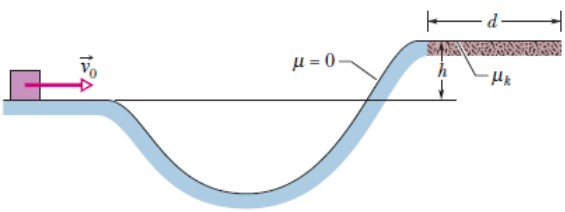
3. In a 1901 circus performance, Allo "Dare Devil" Diavolo introduced the stunt of riding a bicycle in a loop-the-loop. Assuming that the loop is a circle with radius *R*=2.7 m, what is the least speed *v* that Diavolo and his bicycle could have at the top of the loop to remain in contact with it there?



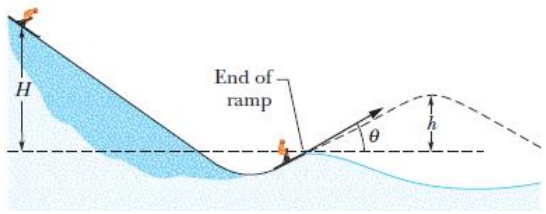
Answer: 5.1 m/s

4. A block slides along a track from one level to a higher level after passing through an intermediate valley. The track is frictionless until the block reaches the higher level. There a frictional force stops the block in a distance *d*. The block's initial speed is v_0, the height difference is *h*, and the friction coefficient is μ_k. Find *d*.

Answer:d= $v_0^2/2\mu g - h/\mu$



5. A skier of mass *m* starts from rest at height *H* above the end of a ski-jump ramp and leaves the ramp at angle θ. Neglect the effects of air resistance and assume the ramp is frictionless. *m*, *H* and *θ* are known. (a) What is the maximum height *h* of his jump above the end of the ramp? (b) If he increased his weight by putting on a backpack, would *h* then be greater, less, or the same?



Answer: $h = H\sin^2\theta$