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Rolling vs. Sliding: The inclusion of non-conservative work in the classic comparison ALEX CHEDIAK[1], California Baptist University, TERRY BUEHLER[2], U.C. Berkeley, BENJAMIN LEE, DANIEL DONALDSON, California Baptist University — A semester-long mechanics course typically covers moment of inertia, angular velocity, and rolling. A classic comparison is made between rolling without slipping and sliding without friction. In either case, no non-conservation work is performed—all the gravitational potential energy that the rolling or sliding object possesses at the top of the incline plane is converted into kinetic energy. In the case of the sliding object, the kinetic energy term is simply $\frac{1}{2}mv^2$. In the case of the rolling object, the kinetic energy term is $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$. The friction here is *static* not *kinetic,* so it does no mechanical work. Since the sliding object has no angular velocity, its linear velocity is greater than that of the rolling object, and it reaches the bottom of the track faster. But if a rolling and sliding object, each of the same material, were to race down an incline plane, which would win? The answer depends on the *effective coefficient of friction,* C. If $C > \mu_s$, which will occur at angles approaching 90°, the rolling object slips. And if $C < \mu_k$, the rolling object has a greater linear acceleration and wins the race to the bottom. Experimental results to verify a theoretical model (including the dependency on incline angle) will also be presented.

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