Warm Up: Work and Energy

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1 Memory Bank

- $KE = \frac{1}{2}mv^2$ ... Definition of Kinetic Energy
- $W = KE_f - KE_i$ ... Work-energy theorem.
- $U = mgy$ ... Gravitational potential energy.
- $KE_i + PE_i = KE_f + PE_f$ ... One form of energy conservation. Consider that potential energy is just stored energy created by performing work, so this statement is not that different from the official work-energy theorem.

2 Work and Energy

1. In Fig. 1 below, a system begins with height y_1. The zero-point of gravitational potential energy is located at the ground. The system travels through the loop when released. If y_1 is the minimum necessary height, we know that $N = 0$ at point 2.
   - Start by writing down the *gravitational potential energy* at points 1 and 2.
   - Assume that the system begins from rest. What is KE_i?
   - Assume the system is moving at velocity v at point 2, and has a mass m. What is the kinetic energy?
   - At point 2, assume that the centripetal force is provided by the weight force, since $N = 0$. Solve for mv^2.
   - Substitute everything into the energy conservation formula and solve for y_1. If $y_1 = 80$ m, how fast will the system be moving at ground level?

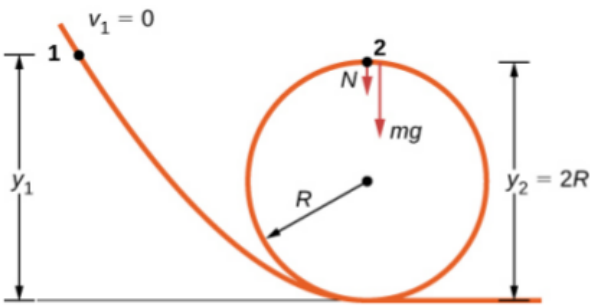

Figure 1: The classic loop-the-loop problem.