Honors Physics **Test: Momentum and Kinetic Energy** **Mr. Kelley**

$\rho = mv$ $\quad \mathrm{KE} = \frac{1}{2}mv^2$ $\quad \mathrm{PE} = mgh$ $\quad \rho_\circ = \rho_f$ $\quad \mathrm{KE}_\circ + \mathrm{PE}_\circ = \mathrm{KE}_f + \mathrm{PE}_f$

1. How fast is a Steinway Model D Grand Piano (990 lb) moving when it hits the ground from the 3rd floor (8.0 m)? How fast is a banana (125 g) moving if it falls from the third floor?

   - What is the maximum kinetic energy of the piano? (2.2 lb = 1 kg)

   - What is the maximum kinetic energy of the banana?

2. A 2 kg piece of clay hits a 2.5 kg piece of iron in outer space. If the clay was traveling at 16 m/s with respect to the iron:

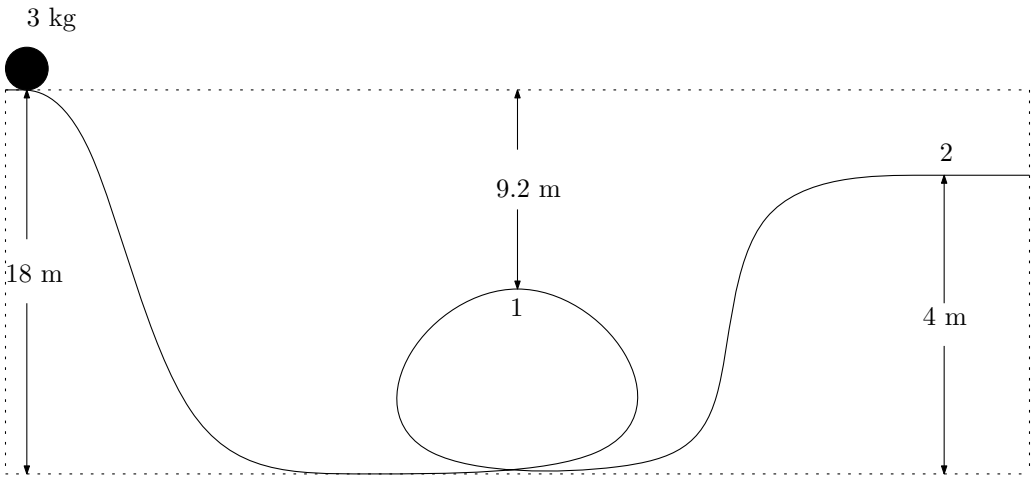
   (a) What will the final velocity be if the two objects stick together?

(b) What is the initial kinetic energy of the system?

(c) What is the final kinetic energy of the system?

3. A 160 g billiard ball, with initial velocity 10 m/s, hits a 145 g baseball. The billiard ball deflects at an angle of 15° at 8 m/s. What is the magnitude and direction of the baseball's velocity?

4. Find the velocity of the ball on this frictionless track at points 1 and 2.



5. A tennis ball hits a duck head-on. The duck was flying with a speed of 5 m/s, and the tennis ball was traveling with a speed of 18 m/s. If the tennis ball bounces straight back (reverses direction) with a speed of 4 m/s, how fast is the duck now going? The duck has a mass of 1 kg and the tennis ball 57 g. (Hint: UNITS! SIGNS!)

6. Little Sally is on a collision course with a wall. Her tricycle is out of control and she can't hit the brakes. The wall is 2 meters wide. Superman knows he can reach her when she is 1 m away from the wall. If he catches her while flying perpendicular to her motion, how fast should he be going to *just* miss the wall?

   Sally's mass and velocity are $m_s = 20$ kg and $v_s = 3.5$ m/s. Superman's mass is 75 kg. Draw Superman in the figure, and the desired path of Sally/Superman.

   Hint: $\tan^{-1}(\frac{y}{x}) = \theta \iff \frac{y}{x} = \tan(\theta)$